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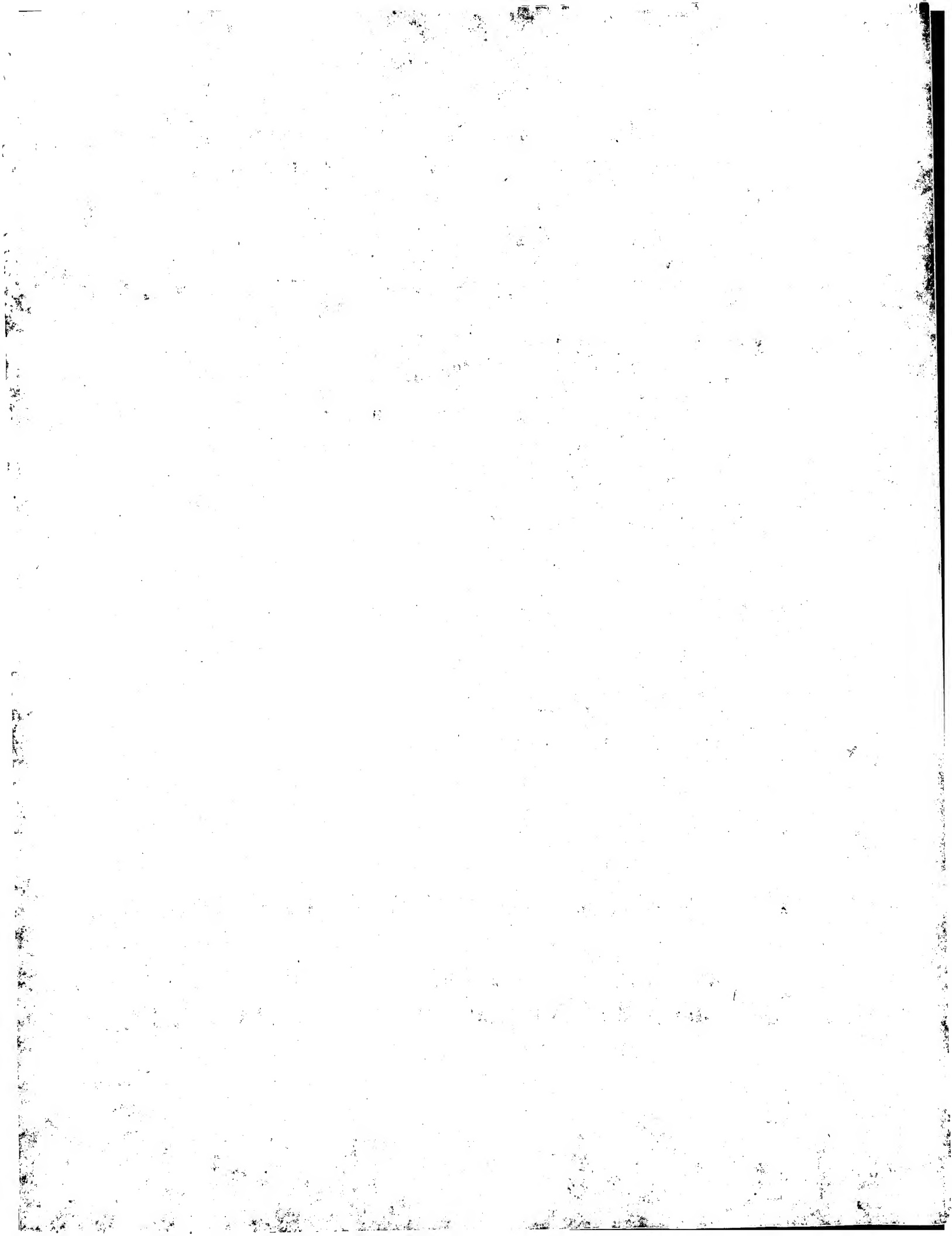
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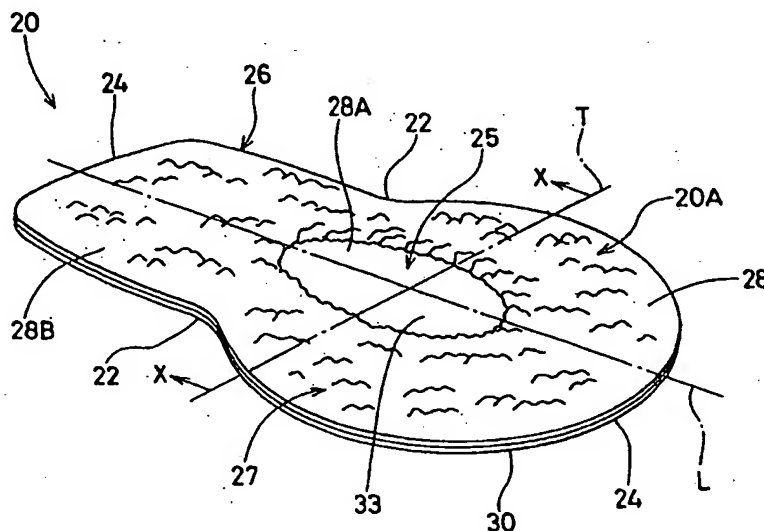
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(54) Title: **ABSORBENT ARTICLE FOR WEARING IN SUPPORTING GARMENT**

## (57) Abstract

An absorbent article for wearing in a supporting garment is disclosed. The absorbent article has a body facing side and a garment facing side. The absorbent article comprises a topsheet disposed at the body facing side, a backsheet disposed at the garment facing side, and an absorbent component. The absorbent article has an acquisition zone and a periphery zone. The topsheet has a topsheet opening at the acquisition zone, and the topsheet extends at the periphery zone. The absorbent component at the acquisition zone is exposed through the topsheet opening. The acquisition zone is capable of substantially maintaining sustained contact with and covering at least a portion of the surface of the wearer's labia minora when the absorbent article is applied on the wearer's body. The periphery zone covers at least a portion of the surface of the wearer's labia majora when the absorbent article is applied on the wearer's body.

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# ABSORBENT ARTICLE FOR WEARING IN SUPPORTING GARMENT

## FIELD OF THE INVENTION

The present invention relates to absorbent articles such as sanitary napkins, panty liners, incontinence pads, and the like. More particularly, the present invention relates to absorbent articles for use with a supporting garment, such as a menstrual pant (or panty).

## BACKGROUND OF THE INVENTION

Absorbent articles such as sanitary napkins, pantliners, and incontinence pads are devices that are typically worn in the crotch region of an undergarment. These devices are designed to absorb and retain liquid and other discharges from the human body and to prevent body and clothing soiling. Sanitary napkins are a type of absorbent article worn by women in a pair of panties that is normally positioned between the wearer's legs, adjacent to the perineum. Sanitary napkins of a wide variety of shapes and dimensions are currently used by women for the collection of menses and other bodily discharges.

In the past, a number of efforts have been directed at providing sanitary napkins that maintain contact with the wearer's body. One attempt to provide such body contact is disclosed in U.S. Patent 2,747,575 issued May 29, 1956 to Mercer. The Mercer patent

discloses a catamenial bandage having a longitudinal hump which bulges towards and may contact the body of the wearer. The catamenial bandage described in the Mercer patent suffers from several disadvantages, however. For instance, the size and shape of the absorbent pad and hump in the Mercer bandage appear to limit the conditions under which the bandage is able to maintain contact with (and conform to) the body of the wearer.

U.S. Patent No. 4,425,130 issued to DesMarais on January 10, 1984, discloses a compound sanitary napkin that comprises a primary menstrual pad and a panty protector joined to one another at their corresponding ends in such a manner that the two constituents are free to move relative to one another along essentially their entire common length. The primary menstrual pad is intended to absorb the bulk of the bodily fluids discharged by the user, while the panty protector is intended to protect the user's garments from soiling. In use, the relative freedom of movement between the primary menstrual pad and the panty protector serves to maintain the primary menstrual pad adjacent to the user's crotch region while the panty protector remains associated with the user's undergarment.

It is also desirable that sanitary napkins, not only maintain contact with, but conform as closely as possible to the wearer's body. Such a body-conforming capability increases the effectiveness of the sanitary napkin by reducing the possibility that menses will travel around the perimeter of the sanitary napkin and leak. There have been a number of recent efforts to provide sanitary napkins and other absorbent articles with improved body-conforming characteristics. For example, U.S. Patent 4,950,264 issued to Osborn on August 21, 1990, is directed to a thin, flexible sanitary napkin that is capable of handling medium to high menstrual flows. The sanitary napkin in the Osborn patent is described as being highly flexible and conforming very well to the various shapes of the female urogenital region. The Osborn patent discloses a sanitary napkin having a flexure resistance of less than about 130 grams; a test capacity of at least about 8 grams (per a 66.5 square centimeter section); and a total capacity of at least about 20 grams. The sanitary napkin may have a caliper of 2 mm, or less. The Osborn sanitary napkin is described as being worn in the wearer's underwear, and is preferably scaled to the width of the crotch of the wearer's underwear.

In addition, PCT International Patent Application Publication No. WO 94/16658, entitled "Generally Thin, Flexible Sanitary Napkin With Central Absorbent Hump",

published in the name of Osborn on August 4, 1994, discloses a generally thin, flexible sanitary napkin which has a central absorbent hump, and is capable of handling medium to high menstrual flows. The hump is particularly useful in fitting into the space between the wearer's labia to more readily intercept menses and other bodily discharges when they  
5 leave the wearer's body. The search, however, has continued for improved sanitary napkins, particularly sanitary napkins that will achieve even better fit.

Further, it is preferable that sanitary napkins provide reduced wet feeling (i.e., less rewet) to the wearer even when the sanitary napkins absorb heavy quantity of body fluid. A number of attempts have been made to improve rewet. For example, there is a sanitary  
10 napkin having a center aperture on the body facing side of the sanitary napkin such that body fluid is absorbed through the center aperture. The sanitary napkin provides reduced rewet or reduced body fluid leakage at the periphery of the sanitary napkin. Such a sanitary napkin having a center aperture is disclosed in, e.g., JP Patent publication 94/1702-B published on January 19, 1994, and JP Patent publication 98/165436-A  
15 published on July 23, 1998. However, the center aperture disclosed in these publications are relatively big. Therefore, there are more opportunities that the wet center aperture contacts the wearer's body which is sensitive to feeling wetness.

Sanitary napkins are typically worn in a loose-fitting undergarment. Such sanitary napkins are necessarily designed to be large enough so that in the event of any shifting of  
20 the sanitary napkins from their position under the vaginal introitus, they will still be able to intercept the wearer's bodily discharges. Further, in the event of shifting of the sanitary napkins, the wet portion of the sanitary napkins will have more opportunities to contact a portion of the wearer's body which is sensitive to feeling wetness.

Thus, there is a need for an absorbent article that fits closely, and comfortably  
25 against the wearer's body which is not required to be designed to compensate for poorly-fitting undergarments. There is also a need for an absorbent article that fits closely, and comfortably against the wearer's body and provides reduced rewet to the wearer.

### SUMMARY OF THE INVENTION

30 The present invention relates to an absorbent article for wearing in a supporting garment. The absorbent article has a body facing side and a garment facing side. The

absorbent article comprises a topsheet disposed at the body facing side, a backsheet disposed at the garment facing side, and an absorbent component. The absorbent article has an acquisition zone and a periphery zone. The topsheet has a topsheet opening at the acquisition zone, and the topsheet extends at the periphery zone. The absorbent component at the acquisition zone is exposed through the topsheet opening. The acquisition zone is capable of substantially maintaining sustained contact with and covering at least a portion of the surface of the wearer's labia minora when the absorbent article is applied on the wearer's body. The periphery zone covers at least a portion of the surface of the wearer's labia majora when the absorbent article is applied on the wearer's body.

The present invention also relates to an absorbent article for wearing in a supporting garment. The absorbent article has a body facing side and a garment facing side. The absorbent article comprises a topsheet disposed at the body facing side, a backsheet disposed at the garment facing side, and an absorbent component. The absorbent article has an acquisition zone and a periphery zone. The topsheet has a topsheet opening at the acquisition zone, and the topsheet extends at the periphery zone. The absorbent component includes a storage layer and a distribution layer. The storage layer is disposed adjacent the body facing side and has an acquisition opening at the acquisition zone, and the storage layer extends at the periphery zone. The distribution layer is disposed adjacent the garment facing side, and the distribution layer extends underneath the acquisition opening and the storage layer. The distribution layer is exposed through the topsheet opening and the acquisition opening. The acquisition zone is capable of substantially maintaining sustained contact with and covering at least a portion of the surface of the wearer's labia minora when the absorbent article is applied on the wearer's body. The periphery zone covers at least a portion of the surface of the wearer's labia majora when the absorbent article is applied on the wearer's body.

#### BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which:



FIG. 1 is a perspective view of one embodiment of an absorbent article of the present invention;

FIG. 2 is a top plan view of the absorbent article shown in FIG. 1;

FIG. 3 is an exploded perspective view of the absorbent article shown in FIG. 1;

5        FIG. 4 is a cross-sectional view of the absorbent article shown in FIG. 1, taken along line X-X;

FIG. 5 is a bottom plan view of the absorbent article shown in FIG. 1;

FIG. 6 is an enlarged side view of the mechanical fastening material on the garment-facing side of the absorbent article;

10        FIG. 7 is a bottom plan view of an alternative embodiment of the absorbent article;

FIG. 8 is a cross-sectional view of an alternative embodiment of the absorbent article shown in FIG. 1, taken along line X-X;

15        FIG. 9 is a front view of a preferred embodiment of a menstrual undergarment for use with the absorbent article of the present invention;

FIG. 10 is a rear view of a preferred embodiment of a menstrual undergarment for use with the absorbent article of the present invention;

20        FIG. 11 is a cross-sectional view taken transversely through a portion of a wearer's body which shows how a prior art conventional pair of panties often fit when the wearer's legs are apart;

FIG. 12 is a cross-sectional view taken transversely through a portion of a wearer's body which shows how a prior art conventional pair of panties often fit when the wearer's legs are together;

25        FIG. 13 is a frontal photograph which shows how a prior art conventional pair of panties often fit when the wearer's legs are apart;

FIG. 14 is a frontal photograph which shows how a prior art conventional pair of panties often fit when the wearer's legs are together;

FIG. 15 is a frontal photograph which shows one example of how the menstrual undergarment for use with the absorbent article of the present invention fits when the wearer's legs are apart;

5 FIG. 16 is a frontal photograph which shows one example of how the menstrual undergarment for use with the absorbent article of the present invention fits when the wearer's legs are together;

FIG. 17 is a cross-sectional view taken transversely through a portion of a wearer's body which provides one example of how the menstrual undergarment used with the absorbent article of the present invention fits when the wearer's legs are apart;

10 FIG. 18 is a cross-sectional view taken transversely through a portion of a wearer's body which provides an example of how the menstrual undergarment used with the absorbent article of the present invention fits when the wearer's legs are together;

FIG. 19 is a cross-sectional sagittal view of a human female wearer showing the absorbent article of the present invention in one disposition;

15 FIG. 20 is a transverse cross-sectional view of a human female wearer showing the absorbent article of the present invention in the disposition shown in FIG. 19;

FIG. 21 is a transverse cross-sectional view of a human female wearer showing the absorbent article of the present invention in alternative disposition;

FIG. 22 is a top plan view of an alternative embodiment of the absorbent article;

20 FIG. 23 is a cross-sectional view of the absorbent article shown in FIG. 22 taken along line Y-Y;

FIG. 24 is a cross-sectional view of an alternative embodiment of the absorbent article shown in FIG. 22 taken along line Y-Y;

25 FIG. 25 is a perspective view of an alternative embodiment of the absorbent article; and

FIG. 26 is a top plan view of the absorbent article shown in FIG. 25.

### DETAILED DESCRIPTION OF THE INVENTION

All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

- 5       “Comprising” means that other steps and other elements which do not affect the end result can be added. This term encompasses the terms “consisting of” and “consisting essentially of”.

10       The present invention is directed to absorbent articles for wearing by a human female such as sanitary napkins, panty liners, and adult incontinence pads ("absorbent pads") for use with a specially designed supporting garment (or undergarment), such as a menstrual pant (or panty).

15       The absorbent article of the present invention has an acquisition zone and a periphery zone. The topsheet has an opening at the acquisition zone such that the absorbent component located at the acquisition zone is exposed through the opening. When the absorbent article is applied on the wearer's body, the acquisition zone contacts and covers at least a portion of the surface of the wearer's labia minora. The absorbent component exposed at the acquisition zone directly contacts and covers at least a portion of the surface of the wearer's labia minora. It is known that body fluid eventually flows out from the wearer's body through the space between the interior surfaces of the wearer's labia minora. The direct contact of the absorbent component with portions of the surfaces of the wearer's labia minora provides an opportunity for superior acquisition of body fluid at the source of body fluid. Because the topsheet is absent in the acquisition zone, body fluid transfer from the wearer's body to the absorbent component is not interfered. Further, because the absorbent component typically has ability to acquire body fluid higher than an ordinary topsheet material, body fluid tends to enter the absorbent component rather than flowing on the surface of the absorbent component. This reduces body fluid flowing on the body facing side of the absorbent article, thereby reducing leakage of body fluid, compared with a conventional product having a topsheet on which body fluid sometimes flows and leaks.

30       After the absorbent component acquires body fluid, the absorbent component becomes wet. Typically, the absorbent component having a high ability to acquire body fluid is highly wettable. Although such a wet portion of the absorbent component is

5 exposed at the acquisition zone and contacts the wearer's body, the wearer does not feel wetness or feels minimal wetness because the portion where the absorbent component contacts is limited. It is believed that the wearer does not feel wetness or is less sensitive to feeling wetness at the surface of the labia minora than at a portion of the surface of the  
10 wearer's body outside the wearer's labia minora. Typically, the wearer becomes more sensitive to feeling wetness as it goes outwardly from the surface of the wearer's labia minora toward the surface of the wearer's labia majora, further toward the surface of the wearer's body outside the wearer's labia majora. Preferably, the acquisition zone at which the absorbent component is exposed covers the interior surface of the wearer's labia  
15 minora or the exterior surface of the wearer's labia minora when the absorbent article is placed in a right position with the wearer's body. More preferably, the acquisition zone is able to cover both the interior surface and the exterior surface of the wearer's labia minora. The acquisition zone may cover a portion of the surface of the wearer's labia majora. The acquisition zone which is able to cover a portion of the wearer's labia majora tolerates a degree of misplacement of the absorbent article with the wearer's body, yet  
20 covers the desired portion of the wearer's body. However, the acquisition zone should have minimal to no extension beyond the labia majora so as to minimize giving wet feeling to the wearer.

The absorbent article is preferably worn with a menstrual panty that comfortably  
25 fits against and conforms to at least the surface of the wearer's labia. This conforming fit is present regardless of whether the wearer's legs are apart, or together. The menstrual panty preferably maintains a modified cusp-shaped cross-sectional configuration in this area throughout a range of body motions. The absorbent article preferably does not alter or override the tendency of the menstrual panty to achieve this fit. The acquisition zone  
30 of the absorbent article preferably flexes under the forces exerted by the menstrual panty so that it assumes a similar shape (and preferably the same modified cusp shape) in this region as the menstrual panty. The flexibility in the acquisition zone of the absorbent article in cooperation with the forces exerted by the menstrual panty enables the acquisition zone to maintain sustained contact with and cover at least a portion of the surface of the wearer's labia minora. The sustained contact ensures the absorbent article to acquire body fluid near the source of body fluid as long as possible over a period of use of the absorbent article.

The absorbent article and menstrual panty preferably function in a manner that can be thought of as being analogous to covering a cut with a bandage. Body fluids are

captured preferably at or near their source by using close body contact and comfortable forces to hold the absorbent article in place at the source of body fluids. This can be contrasted with using overly-sized sanitary napkin in a loose-fitting pair of panties, which function in a manner that can be analogized to the use of a drop cloth beneath the source of bodily fluids.

The topsheet extends at the periphery zone of the absorbent article. The periphery zone covers at least a portion of the surface of the wearer's labia majora when the absorbent article is applied on the wearer's body. Preferably, the periphery zone covers all the surface of the wearer's labia majora. The periphery zone may cover a portion of the surface of the wearer's body outside the labia minora. Body fluid is primarily acquired at the acquisition zone by direct contact of the absorbent component with a portion of the surface of the wearer's labia minora, and preferably is not deposited on the periphery zone when the absorbent article is placed in a right position with the wearer's body. This reduces the opportunity that body fluid is absorbed into the absorbent component through the topsheet at the periphery zone. Therefore, the topsheet remains relatively visually clean and relatively dry. It is important to maintain dryness at the periphery zone because the periphery zone contacts the surface of the wearer's labia majora which is more sensitive to feeling wetness. The dry topsheet also helps to isolate body fluid absorbed in the absorbent component from the wearer's skin over a long period of time. Visual cleanness at the periphery zone of the topsheet gives the wearer a feeling of security against leakage of body fluid in a lateral direction and/or a longitudinal direction because the periphery zone of the absorbent article remains visually clean.

The periphery zone of the absorbent article does not need to have superior body fluid acquisition (though it may have superior body fluid acquisition). Therefore, the topsheet of the periphery zone can be optimized to prevent rewet and/or to improve softness to the wearer's skin without a need to compromise with inconsistent functions, such as superior body fluid acquisition.

The absorbent article preferably acquires a majority of body fluid, more preferably all of the body fluid, through the acquisition zone. Thus, the acquisition zone serves as a vestibule for body fluid to enter the absorbent article. Body fluid acquired through the acquisition zone is preferably distributed toward the periphery zone. Thus, the periphery zone provides storage capacity of body fluid.

# 1. The Absorbent Article

The term "absorbent article", as used herein, refers to articles which absorb and contain body exudates, such as body fluid. More specifically, the term refers to articles which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "absorbent article" is intended to include sanitary napkins, pantliners, and incontinence pads (and other articles worn in the crotch region of a garment).

The term "disposable" refers to articles which are intended to be discarded after a single use and preferably recycled, composted, or otherwise disposed of in an environmentally compatible manner. (That is, they are not intended to be laundered or otherwise restored or reused as an absorbent article.) In the preferred embodiments illustrated in FIGS. 1-5, the absorbent article is a menstrual pad designated 20 that is designed to replace conventional sanitary napkins.

The term "sanitary napkin", as used herein, refers to an article which is worn by females adjacent to the pudendal region that is intended to absorb and contain the various exudates which are discharged from the body (e.g., blood, menses, and urine). Although the present invention is shown in the drawings as a menstrual pad that is intended to replace conventional sanitary napkins, it should be understood that the present invention is not limited to the particular types or configurations of absorbent articles shown in the drawings.

The absorbent article 20 of the present invention has two sides or two surfaces, a body facing side or body facing surface 20A and a garment facing side or garment facing surface 20B. The absorbent article 20 is shown in FIGS. 1 and 2 as generally viewed from its body facing side 20A. The body facing side 20A is intended to be worn adjacent to the wearer's body. The garment facing side 20B (refer to FIG. 4) is intended to be placed adjacent to the supporting garment when the absorbent article 20 is worn.

The absorbent article 20 has two centerlines, a longitudinal centerline L and a transverse centerline T. The term "longitudinal", as used herein, refers to a line, axis or direction in the plane of the absorbent article 20 that is generally aligned with (e.g., approximately parallel to) a vertical plane which bisects a standing wearer into left and right body halves when the absorbent article 20 is worn. The terms "transverse" or "lateral" used herein, are interchangeable, and refer to a line, axis or direction which lies

within the plane of the absorbent article 20 that is generally perpendicular to the longitudinal direction. The absorbent article also has two spaced apart longitudinal edges 22, two spaced apart transverse or end edges (or "ends") 24, which together form the periphery 26 of the absorbent article. In the embodiment shown in FIG. 1, the absorbent article 20 has a flat configuration.

The absorbent article 20 may have any suitable plan view configuration. Suitable configurations include, but are not limited to: oval; race-track shaped; shapes which have convexly-inward longitudinal side edges (e.g., hourglass shapes). In the particularly preferred embodiment shown in FIGS. 1-2, the absorbent article has a key-hole shape which has a wider rounded or oval portion which is preferably worn toward the rear of the wearer's body, preferably for covering at least a portion of the wearer's perineum and a generally rectangular extension therefrom (preferably with rounded edges) which is preferably worn toward the front of the wearer's body for covering at least a portion of the wearer's pudendal region.

The absorbent article may have an overall length of less than or equal to about 280 mm, preferably less than or equal to about 220 mm, more preferably less than or equal to about 160 mm, and of more than or equal to about 80 mm, preferably more than or equal to about 100 mm, more preferably more than or equal to about 120 mm. The absorbent article (without including the dimension of flaps or wings if any) may also have a width of less than or equal to about 160 mm, preferably less than or equal to about 140 mm, more preferably less than or equal to about 120 mm, and of more than or equal to about 40 mm, preferably more than or equal to about 50 mm, more preferably more than or equal to about 60 mm. In the preferred embodiment shown in FIG. 2, the absorbent article 20 may have a width T1 at the wider rounded portion of between about 80 mm and about 140 mm and a width T2 at the rectangular extension of between about 50 mm and about 80 mm.

The absorbent article 20 of the present invention has an acquisition zone 25 and a periphery zone 27. The acquisition zone 25 positions generally at the center of the absorbent article 20 such that the acquisition zone 25 includes at least a portion of the absorbent article 20 along the longitudinal centerline L. The periphery zone 27 positions generally at the periphery of the acquisition zone 25 such that the periphery zone 27 includes at least a portion of the absorbent article 20 transversely or longitudinally outside the acquisition zone 25. Suitable configurations of the acquisition zone 25 include, but

are not limited to, oval shape, race-track shape, or circle shape. Alternatively, the configuration of the acquisition zone 25 may have rectangle shape, triangle shape, or polygon shape, or any other shapes which is suitable as an acquisition zone to effectively acquire body fluid at the source of the body fluid. Preferably, the periphery zone 27 is the remainder of the absorbent article 20 other than the acquisition zone 25. However, the periphery zone 27 may be only a portion of the absorbent article 20 transversely and/or longitudinally outside the acquisition zone 25. In the particularly preferred embodiment shown in FIGS. 1-2, the acquisition zone 25 has an oval shape and positions generally at the center in the longitudinal direction and in the transverse direction of the absorbent article 20. The major axis of the oval shape of the acquisition zone 25 is disposed to align with the longitudinal centerline L of the absorbent article 20. The periphery zone 27 is the remainder of the absorbent article 20 and positions to surround the acquisition zone 25.

The acquisition zone 25 may extend along the entire length of the longitudinal centerline L between the end edges 24 such that the absorbent article 20 has three regions extending in the longitudinal direction; the center acquisition zone and two opposite longitudinal periphery zones. If the acquisition zone 25 does not extend between the end edges 24, the acquisition zone 25 may be shifted toward either of end edges 24. The acquisition zone 25 may also extend transversely, e.g., along the entire length of the transverse centerline T between the longitudinal edges 22 such that the absorbent article 20 has three regions extending in the transverse direction; the center acquisition zone and two opposite transverse periphery zones. The acquisition zone 25 may be shifted from the transverse centerline T toward either of end edges 24.

The acquisition zone 25 should be placed in a specific positional relationship with respect to the area of typical body fluid deposition of the absorbent article 20 and with respect to a specific portion of the wearer's body where body fluid is discharged. Thus, the acquisition zone 25 is placed in the vicinity of the point of discharge of body fluid so as to be capable of rapidly acquiring a majority of body fluid at their contact zone. It is preferable that the acquisition zone 25 covers at least a portion of the surface of the wearer's labia minora. The acquisition zone 25 preferably covers portions of the interior surfaces of the wearer's labia minora such that the acquisition zone fits interlabially between the interior surfaces of the wearer's labia minora. More preferably, the acquisition zone 25 covers substantially all of the interior surfaces of the wearer's labia minora up to and including contacting and covering the floor of the wearer's vestibule.



The acquisition zone 25 may cover portions of the exterior surfaces of the wearer's labia minora. The acquisition zone 25 may cover portions of both the interior surface and the exterior surface of the wearer's labia minora. The acquisition zone 25 may cover a portion of the surface of the wearer's labia majora. The acquisition zone which is able to  
5 cover a portion of the wearer's labia majora tolerates a degree of misplacement of the absorbent article with the wearer's body, yet covers the desired portion of the wearer's body, thereby ensuring a majority of, preferably all of, body fluid to be acquired through the acquisition zone. The absorbent article 20 preferably acquires greater than or equal to 50 %, preferably greater than or equal to 60 %, more preferably greater than or equal to  
10 70 %, of body fluid absorbed by the absorbent article 20, through the acquisition zone 25. Preferably, the absorbent article 20 acquires all the body fluid through the acquisition zone 25 when the absorbent article 20 is placed in a right position with the wearer's body. Since body fluid is sometimes discharged in gushes, the acquisition zone 25 should be able to rapidly acquire and transport body fluid from the wearer's body to an element of  
15 the absorbent article 20, such as preferably to the absorbent component 32 with a minimum of body fluid flow resistance. The acquisition zone 25 also preferably provides improved rates of body fluid acquisition. As explained below, the element of the absorbent component 32 (i.e., the distribution layer 33) is exposed at the acquisition zone 25 and directly contacts with the wearer's labia minora, therefore is able to directly and  
20 rapidly acquire discharged body fluid without a resistance against body fluid flow. The acquisition zone 25 is also so flexible that the acquisition zone 25 is able to maintain sustained contact with a portion of the surface of the wearer's labia minora. The sustained contact secures the acquisition zone to acquire body fluid without leakage or with minimal leakage of body fluid outside the acquisition zone 25 over a period of use of the  
25 absorbent article.

The dimension of the acquisition zone 25 is preferably designed to fit the dimension of the surface of the wearer's labia minora. The acquisition zone 25 may extend into a portion of the surface of the wearer's labia majora. However, it is preferable that the acquisition zone 25 does not extend beyond the wearer's labia majora and does  
30 not cover the surface of the wearer's body outside the labia majora.

The overall length of the acquisition zone 25 is preferably chosen to cover at least a portion of the surface of the wearer's labia minora, preferably to cover the entire length of the wearer's labia minora, when the absorbent article is applied to the wearer's body. The width of the acquisition zone 25 is preferably chosen to have a width covering at least

a portion of the wearer's labia minora, preferably the surface of the wearer's labia minora in taking the wearer's labia minora depth into account when the acquisition zone 25 of the absorbent article 20 is inserted interlabially between the wearer's labia minora. More preferably, the overall length and/or width of the acquisition zone 25 are chosen to be able  
5 to allow some tolerance of absorbent article placement against the wearer's body.

In one embodiment, when the acquisition zone 25 has an oval shape as shown in FIG. 2, the acquisition zone 25 may have an overall length of less than or equal to about 120 mm, preferably less than or equal to about 100 mm, more preferably less than or equal to about 80 mm, and of more than or equal to about 30 mm, preferably more than or  
10 equal to about 40 mm, more preferably more than or equal to about 50 mm. The acquisition zone 25 may have a width of less than or equal to about 60 mm, preferably less than or equal to about 50 mm, more preferably less than or equal to about 40 mm, and of more than or equal to about 10 mm, preferably more than or equal to about 15 mm, more preferably more than or equal to about 20 mm.

15 The periphery zone 27 is placed in a specific positional relationship with respect to the area in the absorbent article 20 where body fluid is not typically deposited and with respect to a portion of the wearer's body where body fluid is not discharged, when the absorbent article 20 is placed in a right place with the wearer's body. It is preferable that  
20 the periphery zone 27 of the absorbent article 20 covers at least a portion of the surface of the wearer's labia majora. More preferably, the periphery zone covers all the surface of the wearer's labia majora. The periphery zone may cover a portion of the surface of the wearer's body outside the labia minora. When the acquisition zone 25 covers only a portion of the surface of the wearer's labia minora, the periphery zone 27 may extend into  
25 a portion of the wearer's labia minora (though it is less preferable). It is believed that the wearer becomes more sensitive to feeling wetness as it goes outwardly from the surface of the wearer's labia minora toward the surface of the labia majora, and further toward the surface of the wearer's body outside the labia majora. Therefore, it is important to provide reduced rewet (i.e., to maintain dryness) at the periphery zone because the periphery zone contacts the surface of the wearer's labia majora which is more sensitive to  
30 feeling wetness. As explained below, the topsheet 28 covers the periphery zone 27 of the absorbent article 20 and the storage layer 31 is disposed at the periphery zone 27. The topsheet 28 and the storage layer 31 work as an isolation means to isolate the wearer's skin from the absorbent component 32, thereby reducing or preventing rewet at the periphery zone 27.

The periphery zone 27 does not directly contact a portion of the wearer's body where body fluid is discharged when the absorbent article 20 is placed in a right position with the wearer's body. Body fluid is not typically deposited on the periphery zone 27. This reduces the opportunity that body fluid is absorbed into the absorbent component 32 at the periphery zone 27. Therefore, the periphery zone 27 remains relatively visually clean and relatively dry. The dryness at the periphery zone helps to isolate body fluid absorbed in the absorbent component 32 from the wearer's skin over a long period of time. Visual cleanness at the periphery zone 27 gives the wearer a feeling of security against leakage of body fluid because the periphery zone 27 remains visually clean.

The acquisition zone 25 of the absorbent article 20 is preferably highly flexible, and preferably has a flexure resistance of less than or equal to about 100 grams, more preferably less than or equal to about 70 grams, and most preferably between about 10 and about 50 grams. This allows the acquisition zone 25 of the absorbent article 20 to conform very closely to the wearer's body, e.g., a portion of the surface of the wearer's labia minora, thereby maintaining sustained contact with a portion of the surface of the wearer's labia minora. The periphery zone 27 may have the same or similar flexibility at the acquisition zone 25. In one preferred embodiment, the acquisition zone 25 should be more flexible than the periphery zone 27 such that the acquisition zone 25 is able to conform the shape of the intended portion of the wearer's body. Preferably, the entire portion of the absorbent article 20 is also highly flexible and has a flexure resistance of less than or equal to about 100 grams, more preferably less than or equal to about 70 grams, and most preferably between about 10 and about 50 grams. It allows the absorbent article to conform to the shape assumed by the crotch region of the specially designed supporting garment. In other words, the absorbent article will bend under the body-contacting forces applied by the supporting garment, and will not "overpower" the second skin fit of the supporting garment. The small size and high flexibility also provides the absorbent article with improved comfort.

The periphery zone 27 of the absorbent article 20 is preferably highly absorbent. The periphery zone 27 of the absorbent article preferably has a total capacity of greater than or equal to about 10 grams, more preferably greater than or equal to about 20 grams or greater than or equal to about 25 grams of liquid. The absorbent article 20 is also preferably highly absorbent. The absorbent article preferably has a total capacity of greater than or equal to about 10 grams, more preferably greater than or equal to about 20 grams or greater than or equal to about 25 grams of liquid. Total capacity is measured in

accordance with the method described in the Test Methods section of this specification. To determine the capacity for the periphery zone 27, the periphery zone is cut from the absorbent article to be tested. The test is run on the periphery zone in the same manner as the capacity test described in the Test Methods section of this specification.

5       The highly efficient nature of the periphery zone 27 of the absorbent article 20 may also be expressed in terms of the ratio of the total capacity of the periphery zone 27 of the absorbent article 20 to the surface area of the periphery zone 27 of the absorbent article 20. In some preferred embodiments, the periphery zone 27 of the absorbent article 20 preferably has a ratio of total capacity to surface area of greater than or equal to about  
10   0.3 g/cm<sup>2</sup>, more preferably greater than or equal to about 0.4 g/cm<sup>2</sup>. By way of comparison, the capacity to surface area ratio of an ALWAYS ULTRA thin sanitary napkin sold by The Procter & Gamble Company of Cincinnati, Ohio is about 0.25 g/cm<sup>2</sup>.

FIGS. 1-5 show the individual components of the absorbent article 20 of the present invention. This embodiment of the absorbent article 20 preferably comprises at least  
15   three primary components. These include a body facing topsheet 28, a garment facing backsheet 30, and an absorbent component 32 positioned between the topsheet 28 and the backsheet 30. The absorbent component 32 includes a storage layer 31 and a distribution layer 33. The body facing topsheet, the garment facing backsheet, and the absorbent component can comprise a number of suitable materials, provided that the absorbent  
20   article 20 has the overall characteristics described herein.

The topsheet 28 is disposed over the absorbent component 32. The topsheet 28 has a void area, such as a topsheet opening or topsheet aperture, 28A, and a cover portion 28B.

The topsheet opening 28A is disposed generally at the longitudinal and transverse  
25   center of the topsheet 28 and disposed at the acquisition zone 25 of the absorbent article 20. The topsheet opening 28A may be generally coextensive with the acquisition zone 25. The cover portion 28B may extend into a portion of the acquisition zone 25 to the extent that the cover portion 28B does not interfere with body fluid flowing into the absorbent component 32. However, it should not extend into a majority of the acquisition  
30   zone 25 because the risk that the cover portion 28B interferes body fluid flow at the acquisition zone 25 becomes greater as it extends into the acquisition zone 25. Preferably, the topsheet opening 28A defines the acquisition zone 25 and the cover portion 28B defines the periphery zone 27. Suitable configurations of the topsheet

opening 28A include, but are not limited to, oval shape, race-track shape, or circle shape. Alternatively, the configuration of the topsheet opening 28A may be rectangle shape, triangle shape, or polygon shape. In the preferred embodiment shown in FIG. 3, the topsheet opening 28A preferably has an oval shape and has the generally same shape as the acquisition zone 25. The topsheet opening 28A may also extend along the longitudinal centerline L between the opposite end edges 24. If the topsheet opening 28A has such a configuration, the cover portion 28B may be formed by two strips of the topsheet disposed along the opposite longitudinal edges 22.

The topsheet opening 28A serves as a vestibule at the acquisition zone 25 for fluid to be acquired into the absorbent component 32 (i.e., the distribution layer 33). The distribution layer 33 is exposed from the topsheet opening 28A such that it directly contacts the wearer's body, such as a portion of the surface of the wearer's labia minora. Because there is no barrier for body fluid flow toward the distribution layer 33 at the acquisition zone 25, a majority of body fluid can be rapidly acquired by the distribution layer 33 through the topsheet opening 28A. Preferably, all the body fluid enters the distribution layer 33 through the topsheet opening 28A without being interfered with by the cover portion 28B when the absorbent article 20 is placed in a right position with the wearer's body. Therefore, body fluid will readily and easily pass through the topsheet opening 28A into the distribution layer 33 without having an opportunity to flow along the surface of the topsheet 28.

The cover portion 28B is disposed to surround the topsheet opening 28A and extends at the periphery zone 27. The cover portion 28B of the topsheet 28 may include at least a portion of the topsheet 28 other than the topsheet opening 28A. Preferably, the cover portion 28B includes the entire portion of the topsheet 28 other than the topsheet opening 28A. The cover portion 28B isolates the absorbent component 32 (i.e., the storage layer 31) from the wearer's skin and is preferably able to prevent rewet. The cover portion 28B is preferably soft and may be relatively lofty. A portion of or the entirety of the cover portion 28B does not necessarily need to have a function to allow penetration of body fluid, i.e., the cover portion 28B may be liquid impermeable to completely prevent rewet at the periphery zone 27, because body fluid is not deposited at the cover portion 28B when the absorbent article is placed in a right position with the wearer's body. However, body fluid may be accidentally deposited onto the cover portion 28B by, e.g., misplacement of the absorbent article 20 with the wearer's body. Therefore, it is preferable that the cover portion 28B is liquid permeable. The liquid permeable

cover portion 28B may have vapor permeability. The cover portion 28B can be optimized to prevent rewet and/or to improve softness to the wearer's skin without a need to compromise with inconsistent functions, such as superior body fluid acquisition. In order to prevent rewet, the cover portion 28B may have less hydrophilicity than the element of the absorbent component 32. Preferably, the cover portion 28B has less hydrophilicity than the storage layer 31 which is contiguous with the cover portion 28B. The cover portion 28B may be even hydrophobic.

The topsheet 28 is preferably compliant, soft feeling, and non-irritating to the wearer's skin. A suitable topsheet 28 may be manufactured from a wide range of materials such as woven and nonwoven materials; polymeric materials such as apertured formed thermoplastic films, apertured plastic films, and hydroformed thermoplastic films; porous foams; reticulated foams; reticulated thermoplastic films; and thermoplastic scrims. Suitable woven and nonwoven materials can be comprised of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polymeric fibers such as polyester, polypropylene, or polyethylene fibers) or from a combination of natural and synthetic fibers. The topsheet 28 is preferably made of a hydrophobic material to isolate the wearer's skin from body fluids which have absorbed in the absorbent component 32 (i.e., to prevent rewet). However, in case body fluid discharged from the wearer is accidentally deposited on the topsheet 28, at least the upper surface of the topsheet 28 may be treated to be hydrophilic so that liquids will transfer through the topsheet more rapidly. This diminishes the likelihood that body fluid will flow off the topsheet 28 rather than being drawn through the topsheet 28 and being absorbed by the absorbent component 32. The topsheet 28 can be rendered hydrophilic by treating it with a surfactant. Suitable methods for treating the topsheet 24 with a surfactant include spraying the topsheet 28 material with the surfactant and immersing the material into the surfactant. A more detailed discussion of such a treatment and hydrophilicity is contained in U.S. Patent No. 4,988,344 entitled "Absorbent Articles with Multiple Layer Absorbent Layers" issued to Reising, et al on January 29, 1991 and U.S. Patent No. 4,988,345 entitled "Absorbent Articles with Rapid Acquiring Absorbent Cores" issued to Reising on January 29, 1991. Alternatively, surfactant may be impregnated into the fibers or resin and the topsheet 28 may be formed by the fibers with impregnated surfactant.

In one preferred embodiment, the cover portion 28B of the topsheet 28 may comprise an apertured formed film. Apertured formed films are preferred for the topsheet 28 because they are permeable to body fluid and yet non-absorbent and have a reduced

tendency to allow liquids to pass back through and rewet the wearer's skin. Thus, the surface of the formed film which is in contact with the body remains dry, thereby reducing body soiling and creating a more comfortable feel for the wearer. Suitable formed films are described in U.S. Patent No. 3,929,135, entitled "Absorptive Structures Having Tapered Capillaries", which issued to Thompson on December 30, 1975; U.S. Patent No. 4,324,246 entitled "Disposable Absorbent Article Having A Stain Resistant Topsheet", which issued to Mullane, et al. on April 13, 1982; U.S. Patent No. 4,342,314 entitled "Resilient Plastic Web Exhibiting Fiber-Like Properties", which issued to Radel et al. on August 3, 1982; U.S. Patent No. 4,463,045 entitled "Macroscopically Expanded Three-Dimensional Plastic Web Exhibiting Non-Glossy Visible Surface and Cloth-Like Tactile Impression", which issued to Ahr et al. on July 31, 1984; and U.S. Patent No. 5,006,394 "Multilayer Polymeric Film" issued to Baird on April 9, 1991. One especially preferred material for the topsheet 28 comprises a formed film described in one or more of the above patents and marketed on sanitary napkins by The Procter & Gamble Company of Cincinnati, Ohio as the "DRI-WEAVE" topsheet. The cover portion 28B may have a hydrophilic surfactant incorporated therein during manufacture if necessary.

Other preferred apertured films suitable for use as the cover portion 28B of the topsheet 28 are the apertured films made in accordance with U.S. Patents 4,609,518 and 4,629,643, the latter entitled "Microapertured Polymeric Web Exhibiting Soft and Silky Tactile Impression", both issued to Curro, et al., on September 2, 1986, and December 16, 1986, respectively, and cloth-like formed films made in accordance with U.S. Patent 4,637,819 entitled "Macroscopically Expanded Three-Dimensional Polymeric Web for Transmitting Both Dynamically Deposited and Statically Contacted Fluids From One Surface to the Other", which issued to Ouellette, et al. on January 20, 1987; and U.S. Patent Application Serial No. 08/442,935 entitled "Fluid Transport Webs Exhibiting Surface Energy Gradients" filed in the name of Ouellette, et al. on May 31, 1995 (PCT Publication WO 96/00548, published January 11, 1996).

If such an apertured film topsheet material is used, it can be used as the cover portion 28B *per se*. Preferably, however, it is used in conjunction with nonwoven topsheet material wherein the nonwoven topsheet material overlies such an apertured film. The apertured film, if properly apertured, will provide a reduced tendency for liquids to pass back through and rewet the wearer's skin. Combining both the nonwoven topsheet material and the cloth-like apertured formed film spaces the absorbent

component and liquids therein from the wearer's body, further contributing to keeping the wearer's body dry.

In another embodiment, the topsheet 28 may be formed by a high loft fibrous material. Herein, the term "high loft fibrous material" refers to a low density, but relatively high caliper, fibrous material. It is often assumed that leakage of menses from conventional sanitary napkins occurs primarily as a result of the capacity of absorbent articles being exceeded. However, it has been found that a substantial number of soiling accidents occur as a result of menstrual fluid that does not even enter the sanitary napkin. Often these soiling accidents result from menses which flows adjacent to the wearer's body, and which may flow in or close to the wearer's pubic hair. The absorbent article of the present invention tends to directly and rapidly acquire body fluid at the source of body fluid of the wearer's body, e.g., at the surface of the wearer's labia minora. Therefore, the risk of body fluid flowing adjacent to the wearer's body is reduced. However, it may accidentally happen when the wearer moves, such as walks. For this case, a topsheet with a high degree of "loft" is preferred so that the fibers of the topsheet will get into close contact with the wearer's body and between the wearer's pubic hairs. The high loft topsheet tends to break the flow of menses along the wearer's body, and intercepts menses flowing along the wearer's body, and allows such bodily exudates to be acquired into the absorbent core. Such high loft topsheets may provide a capillary structure that effectively competes with the wearer's body for bodily fluids, such as menses, and directs such fluids into the absorbent article. A good indicator of whether an absorbent article has a body-contacting surface with Z-direction oriented elements is whether the elements on the body-contacting surface are capable of penetrating between the wearer's pubic hairs. Conversely, if the elements comprising the body-contacting surface of the absorbent article lie flat against the wearer's pubic hairs, and compress the pubic hairs, this is an indication that the absorbent article does not have a body-contacting surface with Z-direction oriented elements. One of the preferred topsheet materials is obtained as product code #W-4635 from Stearns Technical Textile of Cincinnati, Ohio. Another preferred high loft topsheet material is obtained as product code r #68317 (rebulked) from Fibertex A/S, Box 8029, Svendborgvej 16, DK-9220 Aalborg Ost, Denmark.

In still other embodiments, the cover portion 28B of the topsheet 28 may be formed by a thin plastic film being liquid impermeable. The plastic film may have a vapor permeability.



The absorbent component 32 preferably includes a storage layer 31 and a distribution layer 33. The storage layer 31 and the distribution layer 33 have dimensions smaller than the topsheet 28 and the backsheet 30. In the preferred embodiment shown in FIGS. 3 and 4, the storage layer 31 and the distribution layer 33 have the generally same shape and size to one another, though the storage layer 31 has a void area as explained below. The distribution layer 33 is disposed at the garment facing side 20B, i.e., at the side of the backsheet 30 and disposed between the backsheet 30 and the storage layer 31. The storage layer 31 is disposed at the body facing side 20A, i.e., at the side of the topsheet 28 and disposed between the topsheet 28 and the distribution layer 31. At least a portion of the storage layer 31 and at least a portion of the distribution layer 33 are disposed to contact one another to form a contact surface. Body fluid is able to transfer from the distribution layer 33 to the storage layer 31 through the contact surface. Preferably, the entire portion of the storage layer 31 is disposed in contact with the distribution layer 33. The storage layer 31 and the distribution layer 33 are preferably joined to each other to maintain integrity of the absorbent component. They may be joined by a regular or irregular patterned layer of adhesive, or any array of separate lines, spirals, or spots of adhesive. Alternatively, they may be joined by any other methods, such as bonding by applying pressure. It should be understood that for purposes of this invention, these types of layers are not necessarily limited to single layers or sheets of material. Thus, the storage layer 31 and the distribution layer 33 may actually comprise laminates or combinations of several sheets or webs of the requisite type of materials. Thus, herein, the term "layer" includes the term "layers" and "layered".

The storage layer 31 has a void area, such as acquisition opening or acquisition aperture, 31A, and a storage portion 31B.

The acquisition opening 31A is disposed generally at the longitudinal and transverse center of the storage layer 28 and disposed at the acquisition zone 25 of the absorbent article 20. The acquisition opening 31A may be generally coextensive with the acquisition zone 25. When the acquisition zone 25 is defined by the topsheet opening 28A, the storage portion 31B preferably does not extend into a portion of the topsheet opening 28A such that the storage portion 31B does not interfere body fluid flowing into the absorbent component 32 at the acquisition zone 25 and does not intercept body fluid before body fluid reaches the distribution layer 33. Preferably, the acquisition opening 31A is a little bigger than the topsheet opening 28A to secure no interference of body fluid flow by the storage portion 31B at the acquisition zone 25. Suitable configurations

of the acquisition opening 31A include, but are not limited to, oval shape, race-track shape, or circle shape. Alternatively, the configuration of the acquisition opening 31A may be rectangle shape, triangle shape, or polygon shape. In the preferred embodiment shown in FIG. 4, the acquisition opening 31A preferably has an oval shape and has the  
5 generally same shape as the topsheet opening 28A, though the size of the acquisition opening 31A is a little bigger than the topsheet opening 28A. The storage portion 31B of the storage layer 31 extends at in the periphery zone 27. The acquisition opening 31A may also extend along the longitudinal centerline L between the opposite end edges 24. If the acquisition opening 31A has such a configuration, the storage layer 31 may be formed  
10 by two strips disposed along the opposite longitudinal edges 22.

The acquisition opening 31A serves as a vestibule at the acquisition zone 25 in cooperation with the topsheet opening 28A of the topsheet 28 for fluid to be acquired into the absorbent component 32 (i.e., the distribution layer 33). The distribution layer 33 is exposed through the acquisition opening 31A and the topsheet opening 28A such that it  
15 directly contacts the wearer's body, such as a portion of the surface of the wearer's labia minora. The majority of body fluid can be rapidly acquired by the distribution layer 33 through the topsheet opening 28A and the acquisition opening 31A because of the acquisition performance and intimate body contact of the distribution layer 33. Because of the acquisition opening 31A, the storage portion 31B has less tendency to be exposed  
20 to gushes of body fluid. Thus, body fluid is acquired by the distribution layer 33 which is the bottom layer of the absorbent component 32 and distributed underneath the storage portion 31B.

The storage portion 31B of the storage layer 31 is disposed to surround the acquisition opening 31A and extends at the periphery zone 27. The storage portion 31B includes at least a portion of the storage layer 31 other than the acquisition opening 31A.  
25 Preferably, the storage portion 31B includes the entire portion of the storage layer 31. The storage portion 31B has a top surface 31C and the bottom surface 31D. The top surface 31C is disposed at the side of the topsheet 28 and the bottom surface 31D is disposed at the side of the distribution layer 33. Body fluid is first absorbed by the  
30 distribution layer 33 at the acquisition zone 25 and the storage portion 31B has less tendency to be exposed to gush of body fluid. The storage portion 31B serves to absorb body fluid distributed to the storage portion 31B by the distribution layer 33 and/or body fluid overflowed from the distribution layer 33. Thus, the storage portion 31B draws body fluid away from the distribution layer 33 such that preferably much of capacity of

the distribution layer 33 becomes available again for another gush of body fluid. In addition, because body fluid is absorbed from the bottom surface 31D which contacts with the distribution layer 33, the capacity of the storage portion 31B is exhausted from the bottom surface 31D toward the top surface 31C. This allows the top surface 31C of the storage portion 31B to remain relatively visually clean and dry. In order to sustain these benefits as long as possible over a period of use of the absorbent article 20, the storage portion 31B should not absorb body fluid too rapidly and have sufficient capacity. It is preferable to control the absorption of the storage portion 31B such that body fluid does not reach the top surface 31C over a period of use of the absorbent article. The dryness at the top surface of the storage portion 31B serves to isolate body fluid from the wearer's skin at the periphery zone 27 and to prevent body fluid from passing out of the absorbent component 32 back through the topsheet 28 and onto the skin of the wearer. The storage portion 31B also helps to provide visually clean impression at the body facing side 20A of the periphery zone 27 of the absorbent article 20. Although it is preferable that body fluid is not deposited onto the periphery zone 27 when the absorbent article is placed in a right position with the wearer's body, the storage layer 31 may collect body fluid deposited onto the storage layer 31 through the cover portion 28B of the topsheet 28.

The storage portion 31B has sufficient capacity to draw body fluid from the distribution layer 33. Preferably, the storage layer 31B has capacity greater than or equal to the amount of body fluid discharged from the wearer over a period of use of the absorbent article. The storage portion 31B preferably has capacity greater than or equal to about 10 grams, more preferably greater than or equal to about 20 grams, or greater than or equal to about 25 grams. In order to impart high capacity to the storage portion 31B, the storage portion 31B may include highly absorbent material such as superabsorbent hydrogel-forming polymeric material. The storage portion 31B preferably may have the generally same capillarity as the distribution layer 33. Preferably, the storage portion 31B may have a little greater capillarity than the distribution layer 33. It helps to establish a positive capillarity force gradient from the distribution layer 33 to the storage portion 31B. The positive capillarity force enables a positive liquid transfer force from the distribution layer 33 to the storage portion 31B. While liquid capillarity can be defined in several ways (e.g., pore size, density, basis weight, etc.), the density and basis weight of the structure are the preferred parameters to define liquid capillarity.

The storage portion 31B has a density and a basis weight per unit area. The density and basis weight values of the storage portion 31B include the weight of the particles of hydrogel-forming material, such that the density and basis weight values will vary depending upon the amount of particles dispersed throughout the storage portion 31B. Thus, the storage portion 31B will generally have a density of from about 0.03 to about 0.3 g/cm<sup>3</sup>, and more preferably within the range of from about 0.05 to about 0.2 g/cm<sup>3</sup>, wherein the storage layer contains up to about 60 % by weight of particles of absorbent gelling material. The basis weight of such a storage portion 31B can range from about 0.01 to about 0.1 g/cm<sup>2</sup>, preferably from about 0.015 to about 0.03 g/cm<sup>2</sup>. The density of the holding zone is calculated from its basis weight and caliper measured on newly unpacked, unfolded, and dissected absorbent article. The caliper is measured using a standard gauge with a sample under a load of 0.1 psi. The basis weight is measured by die-cutting a certain size sample and weighing this sample on a standard scale, the weight and area of the sample determining the basis weight. (It should be noted that the density and basis weight values include the weight of the particles of hydrogel-forming material).

Various types of hydrophilic material can be used in the storage layer 31. Any type of hydrophilic fibers which are suitable for use in conventional absorbent products are also suitable for use in the storage layer 31. Examples of suitable absorbent materials include comminuted wood pulp which is generally referred to as airfelt; creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers, synthetic fibers such as crimped polyester fibers; peat moss; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent hydrogel-forming polymeric material; absorbent gelling materials; or any equivalent material or combinations of materials, or mixtures of these. The configuration and construction of the absorbent component may also be varied (e.g., the absorbent component may have varying caliper zones (e.g., profiled so as to be thicker in the center), hydrophilic gradients, superabsorbent gradients, or lower density and lower average basis weight acquisition zones); or may comprise one or more layers or structures.

In one embodiment, the storage layer 31 comprises an airlaid web with particulate or fibrous superabsorbent hydrogel-forming polymeric material dispersed therein. The airlaid web can comprise a number of different types of materials. In one version of this embodiment, the absorbent component may comprise a blend of synthetic polymeric fibers, cellulosic fibers, and particulate or fibrous superabsorbent hydrogel-forming

polymeric material. In another version of this embodiment, the storage portion 31B may comprise only synthetic polymeric fibers and fibrous or particulate superabsorbent hydrogel-forming polymeric material. In still another version of this embodiment, the storage layer 31 may be comprised entirely of cellulosic fibers (such as airfelt) and  
5 particulate or fibrous superabsorbent hydrogel-forming polymeric material. However, it is preferred that the storage layer 31 comprises at least some synthetic material to increase its compression resistance and resiliency.

A suitable fibrous superabsorbent, hydrogel-forming polymeric material is sold as FIBERDRI superabsorbent by Camelot Technologies Ltd. of High River, Canada. The  
10 FIBERDRI fibrous superabsorbent material is preferred because it has more capacity than many current particulate superabsorbent materials. For example, it may have a capacity of about 25 grams of liquid per gram of superabsorbent material, whereas current particulate superabsorbent materials may have a capacity of about 20 grams/gram. The FIBERDRI material, thus, provides the advantage that a relatively small amount (for  
15 example, about 0.7 grams) of the FIBERDRI material will provide a total amount of capacity for the small sized absorbent component used in the present invention, which is equal to or greater than the total amount of capacity of full-sized sanitary napkins.

In another embodiment, the storage layer 31 can comprise a laminate of tissue and superabsorbent hydrogel-forming polymeric material. Absorbent cores comprising  
20 laminates of tissue and superabsorbent hydrogel-forming polymeric material which can be modified for use herein are described generally in U.S. Patents 4,950,264 and 5,009,653, both issued to Osborn.

In another embodiment, the storage layer 31 may comprise a needle punched airlaid nonwoven web. In a preferred version of such an embodiment, the needle punched airlaid  
25 nonwoven web comprises about 40% by weight of fibrous superabsorbent hydrogel-forming polymeric material and about 60% polyester fibers. (Unless otherwise stated, all percentages specified herein are based upon weight.)

In a particularly preferred embodiment, the storage layer 31 comprises a needle punched nonwoven material comprising rayon fibers and fibrous superabsorbent  
30 hydrogel-forming polymeric material. Such a nonwoven material preferably comprises between about 50% to about 70 % preferably about 65 % staple length viscose rayon fibers, and between about 30 % and about 50 %, preferably about 35 % fibrous superabsorbent hydrogel-forming polymeric material. Suitable viscose rayon fibers are

LYOCELL viscose rayon fibers, type 18453, obtained from Courtaulds Fibers, Inc. of North Axis, Alabama. Suitable fibrous superabsorbent hydrogel-forming polymeric material is the FIBERDRI fibrous superabsorbent material discussed above. The needle punched nonwoven material preferably has a basis weight of about  $0.02 \text{ g/cm}^2$ . This nonwoven material is preferably needle punched with about 60 needles/cm<sup>2</sup>, or more. The more needles used, the higher will be the flexibility of the finished material. Although a single layer of this material can be used for the storage layer 31, at least two layers may be used. More than two layers can be used, particularly if the material is made in lower basis weights. The layers may be joined together, if desired. However, it has been found that the layers are adequately retained in position relative to each other when they are simply placed adjacent to each other. This is believed to be due to the fiber entanglement between the fibers on the surfaces of the layers.

In another embodiment, the storage layer 31 may comprise a carded, thermally-bonded airlaid nonwoven web. An example of such a material comprises about 20% FIBERDRI superabsorbent material fibers, about 25% bicomponent fibers, and about 55% cellulose fluff, and has a basis weight of about  $0.08 \text{ g/cm}^2$ .

The distribution layer 33 is disposed underneath the acquisition opening 31A and the storage layer 31 (i.e., the storage portion 31B). The distribution layer 33 is exposed at the acquisition opening 31A, therefore is able to directly cover and contact a portion of the surface of the wearer's labia minora through the acquisition opening 31A and the topsheet opening 28A. The distribution layer 33 also contacts at least a portion of the storage layer 31, therefore is able to transfer body fluid acquired in the distribution layer 33 to the storage layer 31. Preferably, the distribution layer 33 is disposed underneath the entire area of the acquisition opening 31A and the entire area of the storage portion 31B. Alternatively, the distribution layer 33 may be disposed underneath only a portion of the acquisition opening 31A. For example, the distribution layer 33 may have apertures or be formed by strips of material in the region of the acquisition zone 25.

The distribution layer 33 serves to rapidly collect and transport discharged body fluid into and throughout itself. Since such body fluid is often discharged in gushes, the distribution layer 33 must have some gush handling capacity so as to allow body fluid to freely and quickly move into the distribution layer 33 and the ability to transport liquids from the point of initial contact on the distribution layer 33 to other parts of the

distribution layer 33. The distribution layer 33 also may provide a member that contains and quickly acquires subsequent gushes of liquid.

The distribution layer 33 must have some gush handling capacity so that the distribution layer 33 can rapidly receive practical quantities of body fluid. The gush handling capacity of the distribution layer 33 is related to the void volume of the structure of the distribution layer 33. The distribution layer 33 should, therefore, be manufactured of a material that has sufficient void volume in the interstices or capillaries between the material or fibers to contain practical quantities of body fluid. Void volume within the distribution layer 33 serves as a reservoir or "bucket" for large gushes of body fluid with a minimum resistance to flow within the structure so that the distribution layer 33 may acquire and transport rapidly voided body fluid.

It has been found that the distribution layer 33 should have a percentage void volume greater than or equal to about 80 %, preferably greater than or equal to about 90 %, more preferably greater than or equal to about 95 % (typically between about 93 % and 99 %), so that there is sufficient void volume to contain in-use quantities of liquids or body exudates. The percentage void volume is calculated by the equation:

$$\text{Percentage void volume} = (1 - V_m / V_s) \times 100\%$$

wherein  $V_m$  is the volume of the material determined by dividing the weight of the material or fibers in a given sample by the density of the material or fibers, and wherein  $V_s$  is the volume of the sample calculated by multiplying its area times its caliper measured under a load of 0.1 psi. Preferably, the distribution layer 33 has a void volume of at least about 5 cm<sup>3</sup>, more preferably at least about 10 cm<sup>3</sup>, and most preferably at least about 15 cm<sup>3</sup>. In an especially preferred embodiment, the distribution layer has a void volume of about 20 cm<sup>3</sup>.

In order to maintain a high void volume and a high level of liquid transport, it is believed that the distribution layer 33 should have caliper, measured under a load of 0.1 psi, of greater than or equal to about 0.5 mm, preferably greater than or equal to about 1.0 mm, more preferably greater than or equal to about 1.5 mm, and further more preferably greater than or equal to about 2.0 mm. The basis weight of the distribution layer 33 is preferably between about 0.005 to about 0.04 g/cm<sup>2</sup>, more preferably about 0.015 g/cm<sup>2</sup> to about 0.025 g/cm<sup>2</sup>.

The distribution layer 33 is also flexible especially at a portion of the acquisition zone 25, preferably at the entire portion of the acquisition zone 25. Because there is no topsheet and no storage layer at the acquisition zone 25 of the absorbent article 20, the distribution layer 33 and the backsheet 30 substantially defines flexibility at the acquisition zone 25 of the absorbent article 20. The flexibility of the distribution layer 33 at the acquisition zone 25 allows the absorbent article 20 to maintain sustained contact with and cover a portion of the surface of the wearer's labia minora preferably in cooperation with the specially designed supporting garment.

Various types of hydrophilic material can be used in the distribution layer 33 of the absorbent component 32. Any type of hydrophilic fibers which are suitable for use in conventional absorbent products are also suitable for use in the distribution layer 33. Examples of suitable absorbent materials include comminuted wood pulp which is generally referred to as airfelt; creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers, synthetic fibers such as crimped polyester fibers; high surface area fibers; peat moss; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent polymers; absorbent gelling materials; or any equivalent material or combinations of materials, or mixtures of these.

In one embodiment, the distribution layer 33 may be formed by chemically stiffened, twisted, and curled bulking fibers; high surface area fibers; and binder fibers. The distribution layer comprising these elements is described generally in U.S. Patents 5,549,589 issued to Horney et al. on August 27, 1996.

In a particularly preferred embodiment, the distribution layer 33 comprises a nonwoven material comprising rayon fibers such as viscose rayon fibers and high surface area fibers such as eucalyptus fibers. Such high surface area fibers are useful to increase body fluid distribution in the distribution layer 33. Such a nonwoven material preferably comprises between about 50 % to about 70 %, preferably about 65 % staple length viscose rayon fibers, and between about 30 % and about 50 %, preferably about 35 % of eucalyptus fibers. Suitable viscose rayon fibers are LYOCELL viscose rayon fibers, type 18453, obtained from Courtaulds Fibers, Inc. of North Axis, Alabama. Suitable eucalyptus fibers are eucalyptus grandis, obtained from Aracruz, Brazil. The fibers may be blended together and formed into a web by a variety of methods including wet-laying



method, air-laying method, carding, needle punching or other methods. Air-laying method and needle punching are particularly preferable.

Other embodiments of the absorbent component 32 are possible. FIG. 8 shows an alternative embodiment of the absorbent component 32. The absorbent component 32 shown in FIG. 8 has an acquisition layer 37 at the acquisition zone 25 of the absorbent article 20. The acquisition layer 37 preferably is able to rapidly acquire body fluid and have some gush handling capacity. The acquisition layer 37 may have a percentage void volume greater than or equal to about 80 %, preferably greater than or equal to about 90 %, more preferably greater than or equal to about 95 % (typically between about 93 % and 99 %), so that there is sufficient void volume to contain in-use quantities of liquids or body exudates. Preferably, the distribution layer 33 has a void volume of at least about 5 cm<sup>3</sup>, more preferably at least about 10 cm<sup>3</sup>. In order to maintain a high void volume and a high level of liquid transport, it is believed that the acquisition layer 37 should have caliper, measured under a load of 0.1 psi, of greater than or equal to about 0.5 mm, preferably greater than or equal to about 1.0 mm, more preferably greater than or equal to about 1.5 mm, and further more preferably greater than or equal to about 2.0 mm. The basis weight of the acquisition layer 37 is preferably between about 0.0025 to about 0.04 g/cm<sup>2</sup>, more preferably about 0.015 g/cm<sup>2</sup> to about 0.025 g/cm<sup>2</sup>. The acquisition layer 37 is also able to vertically transfer body fluid to the next layer which is the distribution layer 33 more rapidly than transferring body fluid horizontally. It is preferable that the acquisition layer 37 is able to vertically transfer body fluid more rapidly than the distribution layer 33. It is also preferable that the distribution layer 33 is able to horizontally transfer body fluid more rapidly than the acquisition layer 37. Suitable material for the acquisition layer 37 is obtainable from Rengo Non-Woven Products Co. Ltd., Japan under the designation No. of 623609. The material preferably has a basis weight of about 0.0025 g/cm<sup>2</sup> and a density of about 0.04 g/cm<sup>3</sup>.

In another embodiment, the absorbent component 32 may have an additional storage layer which is disposed underneath the distribution layer 33. The additional storage layer provides additional capacity to the absorbent article 20 and helps to draw body fluid acquired in the distribution layer 33 such that the distribution layer 33 becomes available for second gush. The additional storage layer may have the generally same or similar size and shape with the distribution layer 33. However, the additional layer may have different size and shape from the distribution layer 33. For example, the additional storage layer may have an oval shape similar to the shape of the acquisition zone 25 and

may be disposed underneath the distribution layer 33 at the acquisition zone 25. When the additional storage layer is disposed at the acquisition zone 25, the additional layer should have flexibility such that the acquisition zone 25 of the absorbent article 20 has the flexibility as defined above. Preferably, the entire portion of the additional storage layer is flexible such that the absorbent article 20 has the flexibility as defined above. Alternatively, the additional storage layer may have a shape similar to the shape of the periphery zone 27 and may be disposed underneath the distribution layer 33. The additional storage layer may be formed by any known materials. Preferably, the additional layer is formed by the materials described above for the storage layer 31 of the absorbent component 32.

In another embodiment, the storage layer 31 of the absorbent component may not be provided with a void area, such as an acquisition opening 31A. In this arrangement being without the void area, the storage layer may have a positive hydrophilicity gradient from a portion of the storage layer at the periphery zone 27 to a portion of the storage layer at the acquisition zone 25 (i.e., a portion of the storage layer at the acquisition zone 25 is more hydrophilic than a portion of the storage layer at the periphery zone 27.). The storage layer may have a positive capillarity force gradient from a portion of the storage layer at the periphery zone 27 to a portion of the storage layer at the acquisition zone 25 (i.e., a portion of the storage layer at the acquisition zone 25 has more capillarity than a portion of the storage layer at the periphery zone 27.). These arrangement helps body fluid readily penetrate the storage layer toward the distribution layer 33 at the acquisition zone 25.

In another embodiment, the storage layer 31 may be disposed at the garment facing side and between the backsheet 30 and the distribution layer 33. The distribution layer 33 may be disposed at the body facing side and between the topsheet 28 and the storage layer 31. In this embodiment the storage layer 31 may not be provided with the a void area, such as an acquisition opening 31A.

In another embodiment, the absorbent component 32 may be formed by one single layer. In one version of such an embodiment, the absorbent component 32 has three longitudinally oriented trisections, a central trisection flanked by two laterally outboard trisections. The absorbent component is formed of a single layer of tissue. The single layer of tissue is folded on itself to provide a two-ply thickness at each of the outboard trisections and a single thickness at the central trisection. Preferably, the folded outboard

trisections are disposed at the body facing side of the absorbent article and provides a storage portion of the storage layer. The interval extending longitudinally between the outboard trisections provides an acquisition opening of the storage layer. The center trisection is disposed at the garment facing side and provides a distribution layer.

5 However, the folded outboard trisections may be disposed at the garment facing side of the absorbent article. The two plies of the outboard trisections are preferably adhered together. Absorbent gelling materials are disposed in each of the outboard trisections. The central trisection may be substantially free of absorbent gelling materials. Example of such laminate absorbent cores are described in U.S. Patent 5,460,623 entitled

10 "Trisection Sanitary Napkin" issued to Emenaker, et al. on October 24, 1995. A further operation is preferably performed on such a laminate absorbent component material to provide it with the desired flexibility. The laminate absorbent component can be perforated, slit, or otherwise manipulated to provide it with increased flexibility. In a preferred embodiment, the laminate absorbent component is provided with a plurality of

15 slits oriented in the longitudinal direction to provide increased flexibility. Of course, the slits can be oriented in any other suitable direction, or in more than one direction. An example of a slit laminate absorbent component that can be modified as described above for use herein is described in U.S. Patent 5,658,269 issued to Osborn, et al. on August 17, 1997.

20 The backsheet 30 can be any suitable flexible, liquid impermeable material. Preferably, the backsheet 30 is a polyethylene film having a thickness of from about 0.012 mm to about 0.015 mm. Exemplary polyethylene films are manufactured by Clipay Corporation of Cincinnati, Ohio, under the designation P18-0401 and microflex 1401. The backsheet 30 may be embossed and/or matte finished to provide a more clothlike

25 appearance.

Further, the backsheet 30 may permit vapors to escape from the absorbent component 32 (that is, it may be breathable) while still preventing exudates from passing through the backsheet. A suitable breathable backsheet material comprises an adhesively attached laminate of an apertured film having tapered capillaries, such as that described in

30 U.S. Patent 3,929,135 issued to Thompson on December 30, 1975, and a microporous film. A suitable microporous film is supplied by Exxon Chemical USA, and described in Exxon's U.S. Patent 4,777,073. The breathable backsheet is arranged so that the smaller openings of the tapered capillaries face the absorbent component 32. The microporous film is joined to the side of the apertured film having the larger openings to form the

garment facing side 20B of the absorbent article. Alternatively, the breathable backsheet material may comprise a vapor permeable monolithic film. The monolithic film is advantageous as they can provide high levels of latent heat transfer while preventing soil-through and also while reducing the stiffness of the absorbent article.

5       The use of a breathable backsheet in conjunction with the menstrual panty (described in greater detail below), which preferably has a breathable crotch portion, allows the overall breathability of the system of the absorbent article and the menstrual panty to be controlled and set to an optimal level. This eliminates any variances caused by using the absorbent article randomly with commercially available undergarments that  
10       have different amounts of vapor permeability and non-permeability.

      The topsheet 28, the backsheet 30, and the absorbent component 32 may be assembled in a variety of configurations known in the art (including layered or "sandwich" configurations and wrapped or "tube" configurations). In the preferred  
15       embodiments shown in the drawings, the absorbent article 20 assembled in a sandwich construction in which the topsheet 28 and the backsheet 30 have length and width dimensions generally larger than those of the absorbent component 32. The topsheet 28 and the backsheet 30 extend beyond the edges of the absorbent component 32 to form portions of the periphery 26.

      The topsheet 28 may be joined to the body facing side of the absorbent component  
20       32. The cover portion 28B of the topsheet 28 may be joined to the body facing side of the absorbent component 32 at the periphery zone 27. In other embodiments, the topsheet 28 need not be joined to the absorbent component 32 to enhance the flexibility of the absorbent article 20. The term "joined", as used herein, encompasses configurations in which an element is directly secured to another element by affixing the element directly to  
25       the other element; configurations in which the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element; and configurations in which one element is integral with another element, i.e., one element is essentially part of the other element. The backsheet 30 need not be, and in the embodiment shown preferably is not, joined to the absorbent  
30       component 32 to enhance the flexibility of the absorbent article 20. The portions of the topsheet 28 and backsheet 30 that extend beyond the edges of the absorbent component 32 to form the periphery 26, are preferably joined to each other.

If the topsheet 28 is joined to the absorbent component 32, the topsheet 28 can be joined to the absorbent component 32 in any suitable manner known in the art for this purpose. The topsheet 28 may be joined to the absorbent component 32 by a regular or irregular patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. One adhesive that has been found to be satisfactory for this purpose is manufactured by Findley Adhesive Company of Wauwatosa, Wisconsin as adhesive number 2031. The adhesive is preferably applied an open pattern network of filaments of adhesive such as is disclosed in U.S. Patent 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola, et al. on March 4, 1986. Other exemplary open pattern networks of adhesive filaments comprising several lines of adhesive filaments swirled into a spiral pattern are illustrated by the apparatus and methods shown in U.S. Patent 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent 4,785,996 issued to Ziecker, et al. on November 22, 1978; and U.S. Patent 4,842,666 issued to Werenicz on June 27, 1989. Alternatively, the components of the absorbent article may be joined by heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art. The portions of the topsheet 28 and backsheet 30 that extend beyond the edges of the absorbent component 32 to form the periphery 26, can be joined to each other in any of the manners described herein.

The components of the absorbent article can be described as forming a "unitary structure." The term "unitary structure", as used herein, refers to a construction in which the components are joined together, or integrated together as a unit. The term "unitary structure" includes constructions such as those described above where the topsheet, absorbent core, and backsheet comprise separate components that are joined together. It also covers constructions in which the liquid permeable side and liquid impermeable side of the absorbent articles do not comprise a separate topsheet and/or backsheet. For example, in the latter case, the liquid permeable side, the liquid impermeable side, or both, may comprise a surface of the absorbent component that has the desired characteristics, rather than a separate component.

The garment facing side 20B of the absorbent article 20 may include, and preferably does include a fastener for attaching the absorbent article to the specially designed supporting undergarment. Fasteners comprising adhesives, particularly pressure sensitive adhesives, which have been used to secure absorbent articles, such as sanitary napkins, to the crotch region of conventional panties can be used for this purpose.

Preferably, however, as shown in FIGS. 4 and 5, the garment-facing surface 20B of the absorbent article 20 comprises a mechanical fastening material 70 that is particularly suitable for engaging knit materials, such as the material from which the specially designed supporting undergarment is preferably made. One type of mechanical fastening material is shown in FIGS. 4-6. The mechanical fastening material 70 can be located on any suitable portion of the garment facing side 20B. Preferably, as shown in FIG. 5, the mechanical fastening material 70 is located on the entire portion of the garment-facing surface 20B. In other embodiments, the mechanical fastening material 70 could cover all, or any other suitable portion of the garment facing side 20B of the absorbent article.

The mechanical fastening material 70 shown in FIG. 6 comprises a substrate or surface 72 with an array of prongs in the form of a plurality of small filamentous (or hair-like) projections 74 extending therefrom. The hair-like projections 74 may be of any suitable shape. FIG. 6 shows one preferred shape of the projections 74 in greater detail. The hair-like projections 74 may, but need not, have a hook shape like conventional VELCRO hook fastening material. In the embodiment shown in FIG. 6, the hair-like projections 74 preferably do not have a hook shape. The hair-like projections 74 preferably have a straight shank 76 that tapers so that it generally decreases in diameter from the base 78 of the shank 76 toward the distal end of the shank. More specifically, the shank 76 decreases in diameter from the base 78 of the shank 76 toward the distal end of the shank until about the mid-point of the shank. The diameter of the shank 76 remains constant from about the mid-point of the shank to the distal end of the shank 76. The distal end of the shank 76 preferably has a small spherical engaging means 80 thereon. The hair-like projections 74 in the preferred embodiment shown in the drawings preferably extend at a slight angle from an orientation that is perpendicular (that is, at an angle of about 90 degrees) from substrate. Preferably, the hair-like projections 74 are oriented at an angle that is about 10° less than a perpendicular orientation relative to the substrate.

The mechanical fastening material 70 can be distributed in any suitable pattern across the garment facing side 20B. In a particularly preferred embodiment, as shown in Fig. 5, the mechanical fastening material 70 is distributed in several zones (e.g., three zones, each about 2 cm (about 0.75 inches) wide) in which the orientation of the hair-like projections differs between adjacent zones. More specifically, in the embodiment shown in Fig. 5, the hair-like projections in a central zone that runs along the longitudinal centerline L are oriented at an angle that is about 10° less than a perpendicular orientation

relative to the substrate which is oriented toward one end of the absorbent article. The hair-like projections in the adjacent longitudinal side zones form a similar angle relative to the substrate, but they are oriented toward the opposite end edge of the absorbent article 20. The orientation of the hair-like projections in these different zones is shown by arrows in FIG. 5.

In other embodiments, the mechanical fastening material 70 can be distributed in a pattern that matches the pattern of one or more pre-selected portions of the specially designed supporting garment. For example, the mechanical fastening material 70 can be arranged in a pattern that corresponds to and aligns with the longitudinal stretch control member 52 and/or the angled stretch control members 54 of the menstrual undergarment 38 shown in FIGS. 9 and 10. (The menstrual undergarment is described in greater detail below.) For instance, portions of the mechanical fastening material 70 at each end edges 24 of the absorbent article 20 can be arranged in a chevron pattern to correspond to the angled stretch control members 54 of the menstrual undergarment. In a variation of this embodiment, the mechanical fastening material 70 and/or the other portions of the supporting garment could be designed so that the mechanical fastening material 70 will not engage other than with a particular portion of the supporting garment, such as the longitudinal or angled stretch control members. The alignment of the mechanical fastening material 70 with these portions of the supporting garment can be used as a placement aid to ensure that the absorbent article 20 is positioned properly in the supporting garment. The pattern of mechanical fastening material 70 can also be used to assist the absorbent article 20 in fitting closely against the wearer's body in certain areas. The mechanical fastening material 70 may be disposed in a configuration of two strips 71 as shown in FIG. 7.

The mechanical fastening material 70 shown in FIG. 6 provides the garment facing side 20B of the absorbent article 20 with a fastener that is capable of easily adhering to knit material, and has a sufficiently high holding force even if the supporting garment stretches and contracts. The mechanical fastening material 70 described herein is particularly preferred for use with the specially designed knit supporting undergarment since it will not become detached when the supporting garment stretches and contracts during application of the absorbent article to the undergarment, as will some pressure sensitive adhesives. These and other features are disclosed in PCT Application No. US 98/23861 entitled "Highly Efficient Absorbent Article For Use With Menstrual Pant" filed in the name of Carstens, et al. on November 9, 1998.

In another embodiment, the mechanical fastening material 70 can comprise a material having a "T"-shaped or mushroom-shaped appearance when viewed from the side. One particularly preferred "T"-shaped mechanical fastening material for use on the absorbent article of the present invention is a material known as TP200 available from 3M  
5 Personal Care and Related Products Division of Menomonie, WI.

In addition to the mechanical fastening material described above, and pressure sensitive adhesives, the garment facing side 20B of the absorbent article 20 may employ other alternative types of fasteners. In one non-limiting example, the absorbent article 20 can be provided with a cohesive material that adheres to a cohesive material on the inside  
10 of the crotch portion of the supporting undergarment. As used herein, a "cohesive material" is one which preferentially adheres to itself and not to other materials. Such a material can be used as a placement aid to ensure that the absorbent article 20 is positioned properly in the supporting garment.

FIGS. 9 and 10 show front and rear views of a supporting garment in the form of a  
15 menstrual undergarment 38 that is preferred for use with the present invention. As is shown in FIGS. 9 and 10, the menstrual undergarment 38 comprises a front portion 39 which may be in the form of a front panel, a rear portion 40 which may be in the form of a rear panel, a crotch region or portion 50 which may be in the form of a crotch panel, a pair of leg openings 60 which may be elasticized, and an elasticized waistband 44. The  
20 menstrual undergarment 38 is also provided with a waist opening 46 allowing entry into the menstrual undergarment 38. The menstrual undergarment 38 further comprises an extensible lifting member such as lifting strip 42 disposed along the longitudinal centerline  $L_1$  in the rear portion 40, a longitudinal stretch control member 52 disposed along the longitudinal centerline in the crotch portion 50, and a plurality of angled stretch  
25 control members 54 disposed at an angle A with respect to the longitudinal stretch control member 52 and extending therefrom to the leg elastics 62. It should be noted that any seam or gusset 48 at the front end of the crotch portion 50 is preferably situated so that it lies under or behind (that is, rearward of) the pubic bone so that the pubic bone does not interfere with the fit of the menstrual undergarment. It should also be understood that any  
30 or all of the features of the menstrual undergarment 38 described herein may be knit into the menstrual undergarment, and need not comprise sewn together portions of the menstrual undergarment.



The absorbent article 20 is utilized by placing the absorbent article 20 in the crotch portion of the menstrual undergarment 38. The absorbent article 20 is placed in the crotch portion of the menstrual undergarment with one end extending toward the front section of the menstrual undergarment and the other end towards the back section of the menstrual undergarment. The backsheet 30 is placed in contact with the inner surface of the center of the crotch portion 50 of the menstrual undergarment. The hair-like projections 74 of the mechanical fastening material 70 on the garment facing side 20B of the absorbent article 20 engage with the knit material from which the crotch portion 50 of the menstrual undergarment 38 is made. The wearer then pulls on the menstrual undergarment 38. The menstrual undergarment 38 will typically stretch and contract, until it fits as shown in FIGS. 15 and 16. Alternatively, the absorbent article 20 may be first applied to the wearer's body, then the wearer may pull on the menstrual undergarment 38. Since the absorbent article 20 is flexible, especially at the acquisition zone 25, the acquisition zone 25 of the absorbent article 20 stay in place by a force to hold the acquisition zone 25 of the absorbent article 20 therein. The menstrual undergarment 38 helps the acquisition zone 25 of the absorbent article 20 maintain sustained fit and contact with the wearer's body. The menstrual undergarment 38 also helps the flexible absorbent article 20 conform to the body shape and maintain sustained fit with the wearer's body.

FIGS. 11 and 12, respectively, show examples of how a conventional prior art pair of panties fits in the crotch region when the wearer's legs, LG, are apart, and when they are brought together. As shown in FIG. 11, when the wearer's legs are apart, the crotch region of a conventional pair of panties "gaps" along a longitudinally oriented area centered about the space between the wearer's labia (which are designated by reference letter J). As shown in FIG. 12, the crotch region of these conventional panties sag when the wearer's legs are brought together. A similar comparison is shown photographically in FIGS. 13 and 14. FIG. 13 shows how a conventional pair of panties fits in the crotch region when the wearer's legs are apart. FIG. 14 shows how the panties fit when the wearer's legs are brought together.

The menstrual panty as shown schematically in FIGS. 17 and 18, on the other hand, comfortably fits against and conforms to the inside and outside surfaces of the labia majora whether the wearer's legs are apart, or together. The menstrual panty maintains the coverage of the desired areas of the wearer's body without applying significant "girdle-like" forces. As shown in FIGS. 17 and 18, in cross-section, the menstrual panty preferably maintains a modified cusp-shaped configuration in this area throughout a range

of body motions (that is, dynamically). A similar comparison is shown photographically in FIGS. 15 and 16. The cross-sectional configuration of the menstrual panty is described as being a "modified" cusp-shape because it may, but preferably does not form a point, P, where the curved portions of the cusp-like shape meet in the longitudinally-oriented area in the space between the wearer's labia, but is more rounded, and preferably convex in this area. The modified cusp-shape of the menstrual panty is especially useful to serve the acquisition zone 25 of the absorbent article 20 maintaining sustained fit and contact with the wearer's labia minora, especially sustained fit and contact interlabially with the interior surfaces of the wearer's labia minora.

10 The menstrual panty fits against the wearer's body so closely, particularly in the crotch region, that it is like a comfortable "second skin". The absorbent article 20 preferably does not alter or override the tendency of the menstrual panty to achieve this "second skin" fit. The absorbent article 20 is preferably sufficiently flexible so that it assumes a configuration similar to the crotch region of the menstrual panty. Preferably, 15 the absorbent article 20 also conforms to the shape of the wearer's pudendal region in use. The absorbent article preferably conforms to the shape of the wearer's pudendal region regardless of whether the wearer's legs are together or apart. The acquisition zone 25 of the absorbent article 20 preferably conforms to the shape of the surface of the wearer's labia minora.

20 The absorbent article 20 preferably flexes under the forces applied by the menstrual panty 38 that are used to hold the absorbent article comfortably against the wearer's body. If the absorbent article flexes under these forces, it will not override the tendency of the menstrual panty to achieve the desired fit, and the absorbent article 20 will assume a shape similar to the body shape of the wearer's pudendal region and the crotch region of the menstrual panty 38. The menstrual panty 38 described herein preferably applies 25 body-contacting pressures to the wearer's body of less than or equal to about  $20 \text{ g/cm}^2$ , more preferably less than or equal to about  $15 \text{ g/cm}^2$ . A body-contacting pressure of  $20 \text{ g/cm}^2$  applied by the menstrual panty 38, is a pressure which is high enough that it is on the borderline of being uncomfortable for the wearer.

30 It is recognized that there are other garments, such as Japanese menstrual shorts, that are close fitting. However, such garments tend to apply forces that uncomfortable, particularly on the wearer's legs at those places where the wearer's legs are contacted by the elasticized edges of the menstrual shorts. The menstrual panty 38 described herein, on

the other hand, is particularly preferred because it is capable of applying body-contacting forces along the crotch region thereof which keep the absorbent article 20 in close contact with the wearer's pudendal region, without creating uncomfortable forces on the wearer's legs (greater than or equal to about 20 g/cm<sup>2</sup>) at the places where the wearer's legs are contacted by the leg openings of the menstrual panty 38. Preferably, the edges of the crotch region of the menstrual panty described herein apply a body-contacting pressure to these regions of the wearer's body that is less than or equal to about 20 g/cm<sup>2</sup>.

The absorbent article 20 and menstrual panty 38 also differ from prior sanitary napkins and conventional underwear in the sustained nature of the contact of the absorbent article with the wearer's body. Some current sanitary napkins may occasionally assume a "W"-shaped cross sectional configuration during wear, such as when the wearer is sitting. However, conventional underwear does not provide a constant force against the wearer's body to hold the sanitary napkin in place under all circumstances, such as when the wearer is walking or standing, or when the wearer's legs are apart. The absorbent article 20 and the menstrual panty 38, on the other hand, provide such sustained contact with the wearer's body. The absorbent article may be described as being substantially maintained in sustained contact with the wearer's body, in which case the absorbent article need not be in complete and/or continuous contact with the wearer's body, but is maintained in contact with the wearer's body more than it is out of contact with the wearer's body.

FIGS. 19-21 show a preferred embodiment of the absorbent article 20 of the present invention worn against the body of a wearer W. The urogenital members shown in FIG. 19 include the bladder B, the vagina V, the urethra U, the clitoris C, the large intestine I, the anus AN, the vaginal introitus VI, the perineum P, the labia minora N including the interior surface of the labia minora NI and the exterior surface of the labia minora NE (not shown in FIG. 19), and the labia majora J. The interior surface NI of the labia minora N continuously extending from the vaginal introitus VI. Therefore, body fluid such as menses is known to be eventually discharged through the space between the interior surfaces NI of the labia minora N. Contact of a portion of the absorbent article with the interior surfaces NI provides an opportunity to intercept body fluid flowing through the space between the interior surfaces NI and directly acquires body fluid from there before body fluid reaches the surface of the wearer's body outside the labia minora. Contact of a portion of the absorbent article with the exterior surfaces NE also provides an opportunity to acquire body fluid discharged through the space between the interior surfaces NI of the

labia minora N before body fluid reaches the surface of the wearer's body outside the labia minora. FIG. 19-21 show one example of the relationship of these anatomical features of the wearer W to the absorbent article 20 when the absorbent article 20 is properly worn (In FIGS. 19-21, the undergarment 38 is eliminated).

5        FIGS. 19 and 20 show one non-limiting example of the manner in which the absorbent article 20 may fit adjacent to the wearer's body. In the embodiment shown in FIGS. 19 and 20, the acquisition zone 25 of the absorbent article 20 resides in the space between the portions of the interior surfaces NI of the wearer's labia minora N such that the acquisition zone 25 covers the portions of the interior surfaces NI of the wearer's labia  
10        minora N. The distribution layer 33 exposed at the acquisition zone 25 directly contacts the portions of the interior surfaces NI of the wearer's labia minora N and is able to directly acquire body fluid into the distribution layer 33. The distribution layer 33 of the acquisition zone works as if "sealing" the space between the interior surfaces NI of the labia minora N. This reduces the opportunity of body fluid reaching the surface of the  
15        wearer's body outside the labia minora N. Although the distribution layer 33 exposed at the acquisition zone 25 becomes wet, the wearer does not feel wetness or feels minimal wetness because the wet distribution layer primarily contacts portions of the interior surfaces of the wearer's labia minora N. The acquisition zone 25 maintains sustained contact with portions of the interior surfaces of the wearer's labia minora. Preferably, the  
20        absorbent article 20 maintains sustained contact with the portions of the surfaces of the wearer's body. In FIGS. 19-21, there are some gaps between the absorbent article 20 and the portions of the wearer's body. This is to more clearly show the shape of each absorbent article 20 and portions of the wearer's body. However, in the actual wearing situation, the absorbent article 20 may fit and contacts more closely to the portions of the  
25        wearer's body.

As shown in FIG. 19, the periphery zone 27 is disposed to contact and cover the surface at the wearer's mons pubis and the wearer's perineum P. The absorbent article may cover the wearer's clitoris, but preferably does not extend substantially forward beyond the wearer's mons pubis. The absorbent article 20 may be spaced slightly away  
30        from the clitoris, or it may fit closely against the clitoris, as it does relative to the other regions of the wearer's body. The absorbent article 20 preferably does not extend rearward to contact the wearer's anus to avoid sensitive nerve endings therein. When the absorbent article 20 is of this preferred size, it provides a more comfortable, and less noticeable absorbent article since it occludes less of the crotch region of the wearer's body

and allows air to circulate around the same. As shown in FIG. 20, the periphery zone 27 is disposed to contact the portion of the surface of the wearer's labia majora J and the surface of the wearer's skin outside the wearer's labia majora J. Body fluid is not directly deposited on the periphery zone 27. Therefore, the periphery zone 27 remains relatively visually clean and relatively dry.

FIG. 21 shows another example of the manner in which the absorbent article 20 may fit adjacent to the wearer's body. In this example, although the acquisition zone 25 does not reside in the space between the portions of the interior surfaces NI of the labia minora N to the extent shown in FIG. 20, the acquisition zone 25 covers the distal portion ND of the wearer's labia minora N and portions of the exterior surfaces NE of the wearer's labia minora N. In this example, the distribution layer 33 of the acquisition zone 25 directly contacts the portions of the exterior surfaces NE of the wearer's labia minora N. The distribution layer works as if sealing the labia minora by encompassing the portions of the exterior surfaces NE of the wearer's labia minora N. The distribution layer 33 exposed at the acquisition zone 25 directly acquires a majority of body fluid flowing through the space between the interior surface NI of the wearer's labia minora N. This prevents body fluid from flowing beyond the exterior surface NE of the wearer's labia minora N. In this embodiment, the periphery zone 27 is disposed to contact the portion of the surface of the wearer's labia majora J and the surface of the wearer's skin outside the wearer's labia majora J.

FIGS. 22-24 show another embodiment of the absorbent article of the present invention. The embodiment shown in FIGS. 22 and 24 is intended to provide the absorbent article which is capable of maintaining sustained contact with and covering at least a portion of the surface of the wearer's labia minora.

The absorbent article 120 shown in FIGS. 22 and 23 further comprises a longitudinally-oriented central absorbent hump 100 on its body facing side 20A. The hump 100 is formed by a hump-forming element (or "insert") 102 that is preferably inserted between the distribution layer 33 and the backsheet 30. The hump-forming element enables the distribution layer 33 to protrude beyond the top surface of the topsheet 28 through the topsheet opening 28A and the acquisition opening 31A at the acquisition zone 25.

The hump-forming element 102 is sized to fit completely with the wearer's interlabial space (i.e., the space between the interior surfaces of the labia minora). In one

preferred embodiment, the hump-forming element 102 has a length as measured along its base of about 50 mm. As shown in FIG. 22, the hump-forming element has a top portion that has its ends 104 rounded off (especially apparent when viewed from the side) for improved comfort. The length of the top portion as measured where this rounding commences is preferably about 30 mm. The hump-forming element 102, in this embodiment, preferably has a maximum height or caliper of about 20mm. The width of the hump-forming element 102 as measured at its base is preferably about 10 mm.

In this particular embodiment, as shown in FIG. 23, the insert 102 comprises several elements. These include a first web of material such as first folded web of absorbent material 106, an underlying layer 108, and several pieces of resilient material 110.

The first folded web of absorbent material 106 preferably comprises a material that is capable of quickly moving bodily exudates away from the wearer's body. In the embodiment shown in FIGS. 22 and 23, the first web of material 106 may comprise a hydroentangled nonwoven web comprised of natural fibers, polymeric fibers, copolymeric fibers, or mixtures thereof. A suitable material for the first folded web 106 is known as FIBRELLA-Suominen made by J.W. Suominen Oy of Nakkila, Finland. The first folded web of absorbent material 106 is preferably gradually bent or is folded about a plurality of longitudinally-oriented folding lines into the cross-sectional configuration shown in FIG. 23. As shown in FIG. 23, the first folded web 106 has an inverted U-shaped configuration along its longitudinal centerline. The longitudinal side margins of the first folded web are folded inward and upward inside the inverted U-shaped portion of the folded web to define two smaller U-shaped portions.

The underlying 108 layer preferably comprises a material that is capable of drawing liquids away from the first folded web of absorbent material 106 and storing such liquids. In the embodiment shown in FIGS. 22 and 23, the underlying layer 108 preferably comprises a thermally bonded wet laid nonwoven web. Suitable thermally bonded wet laid nonwoven webs are described in U.S. Patent 5,549,589 entitled "Fluid Distribution Member for Absorbent Article Exhibiting High Suction and High Capacity" issued to Horney, et al. on August 27, 1996. The underlying layer 108 in the embodiment shown in FIGS. 22 and 23, is narrower in width than the first folded web of absorbent material 106 and terminates short of the longitudinal side margins of the first folded web of absorbent material 106 so that it underlies only the inverted U-shaped portion of the first folded web

of absorbent material 106. The underlying layer 108 may or may not be joined to the first folded web of absorbent material 106.

5 The pieces of resilient material 110 are used so that the hump-forming element 102 maintains its maximum height even when the menstrual undergarment presses the absorbent article into close contact with the wearer's body. This allows the hump 100 to continuously cover a maximum amount of the interior surfaces of the wearer's labia minora during use. Preferably, the hump-forming element maintains a maximum height of greater than or equal to at least one of the following amounts in use: about 10 mm, about 12 mm, about 14 mm, about 16 mm, about 18 mm, or about 20 mm.

10 The pieces of resilient material 110 can comprise any material that is suitable for the above purposes. The pieces of resilient material 110 may either be absorbent or non-absorbent. Suitable resilient materials include, but are not limited to absorbent and non-absorbent foams. In one version of the embodiment shown, the pieces of resilient material 110 comprise a radiation cross-linked polyethylene foam known as VOLARA,  
15 type 2A manufactured by Voltek, Inc. of Lawrence, Massachusetts. The VOLARA foam material is three pieces. Each piece is a rectangular parallelepiped which has a square cross-section measuring about 6 mm x 6 mm, and a length of about 50 mm. One piece of resilient material is positioned in each of the U-shaped portions and the inverted U-shaped portions of the first folded web.

20 The pieces of resilient material 110 are attached to the underside of the underlying layer 108. The pieces of resilient material 110 can be attached to the underside of the underlying layer 108 in any suitable manner, such as by adhesives or double-sided adhesive tape. The entire hump-forming element 102 is preferably secured to the absorbent component 32 in a similar manner.

25 FIG. 24 shows another embodiment of the absorbent article 220. The absorbent article 220 has the distribution layer 233 protruding beyond the top surface of the topsheet 28 through the topsheet opening 28A and the acquisition opening 31A at the acquisition zone 25. In this embodiment, the distribution layer 233 is formed to be thicker at the acquisition zone 25 than the periphery zone 27. The thick portion of the distribution layer  
30 233 at the acquisition zone 25 may be achieved by higher basis weight. The thick portion of the distribution layer 233 fits the wearer's interlabial space.

In another embodiment, the absorbent article can be provided with a structure in which an absorbent element can separate (or "decouple") from the backsheet of the absorbent article. This will allow the absorbent element to move into closer contact with the wearer's body in the space between the wearer's labia minora while the backsheet remains in place adjacent to the menstrual undergarment. The detail of such an embodiment is disclosed in PCT Application No. US 98/23861 entitled "Highly Efficient Absorbent Article For Use With Menstrual Pant" filed in the name of Carstens, et al. on November 9, 1998.

FIGS. 25 and 26 shows another alternative embodiment of the absorbent article of the present invention. The absorbent article 320 has a generally oval shape extending in the longitudinal direction L. The absorbent article 20 is provided with optional elastic members 336 that are wrapped around the longitudinal edges 322 of the absorbent article. The optional elastic members 336 form the absorbent article 320 into the desired cup-shaped configuration and provide soft longitudinal edges 322 in the event the longitudinal edges contact the wearer during use. If used, the optional elastic members 336 preferably comprise an elastomeric laminate comprising an elastomeric layer and a coverstock layer, with the coverstock layer being on the outside of the product. Suitable elastomeric laminates are described in U.S. Patent 5,234,422 and 5,308,346 both entitled "Elasticized Sanitary Napkin" issued to Sneller, et al. on August 10, 1993 and May 3, 1994, respectively.

The absorbent article of the present invention can be provided with still other features. For example, the absorbent article can be provided with an optional pair of flaps that are joined to and extend laterally outward from the longitudinal side edges of the absorbent article. In this case, the absorbent article without the flaps can be considered to comprise the main body portion of the overall absorbent article which has the optional flaps. The flaps preferably extend laterally outward from at least a central region along the length of the main body portion. However, since the main body portion may be relatively small in size, it is possible that the flaps may extend outward along the entire length of the main body portion. In other embodiments, the flaps may even be longer than the main body portion.

If optional flaps are provided, they can be joined to the main body portion of the absorbent article in any suitable manner. The flaps can be integral with the main body portion (that is, the flaps can comprise integral extensions of the topsheet and backsheet).



In other embodiments, the flaps can comprise separate components that are joined to the main body portion of the absorbent article.

The flaps can be in any suitable configuration. Suitable flaps are described in Reexamined Patent No. B1 4,589,876 entitled "Sanitary Napkin", issued to Van Tilburg, Certificate of Reexamination issued April 27, 1993; U.S. Patent 4,687,478 entitled "Shaped Sanitary Napkin With Flaps", which issued to Van Tilburg on August 18, 1987; U.S. Patent 5,389,094 entitled "Absorbent Article Having Flaps and Zones of Differential Extensibility" issued to Lavash, et al. on February 14, 1995; U.S. Patent 5,558,663 entitled "Absorbent Article Having Undergarment Covering Components With Zones of Extensibility" issued to Weinberger, et al. on September 24, 1996 and U.S. Patent 5,584,829 entitled "Absorbent Articles Having Panty Covering Components That Naturally Wrap the Sides of Panties", issued to Lavash, et al. on December 17, 1996 (which describe alternatives to flaps that are applied by a wearer); PCT Publication No. WO 97/12576 entitled "Absorbent Article Having Flaps With a Deformed Hinge and Zones of Extensibility", published April 10, 1997; and in International Patent Application Serial No. PCT US 96/15957 entitled "Absorbent Article Having Flaps With Step Configuration and Zones of Extensibility" filed on October 3, 1996, in the name of Lash, et al.

## 20 2. TEST METHODS

### A. Flexure-Resistance

The flexure-resistance of an absorbent article is measured by peak bending stiffness. Peak bending stiffness is determined by a test which is modeled after the ASTM D 4032.82 Circular Bend Procedure, the procedure being considerably modified and performed as follows: The Circular Bend Procedure is a simultaneous multi-directional deformation of a material in which one face of a specimen becomes concave and the other face becomes convex. The Circular Bend Procedure gives a force value related to flexure-resistance, simultaneously averaging stiffness in all directions.

### Apparatus

30 The apparatus necessary for the Circular Bend Procedure is a modified Circular Bend Stiffness Tester, having the following parts:

A smooth-polished steel plate platform which is 102.0 X 102.0 X 6.35 millimeters having an 18.75 millimeter diameter orifice. The lap edge of the orifice should be at a 45 degree angle to a depth of 4.75 millimeters.

5 A plunger having an overall length of 72.2 millimeters, a diameter of 6.25 millimeters, a ball nose having a radius of 2.97 millimeters and a needle-point extending 0.88 millimeter therefrom having a 0.33 millimeter base diameter and a point having a radius of less than 0.5 millimeter, the plunger being mounted concentric with the orifice and having equal clearance on all sides. Note that the needle-point is merely to prevent lateral movement of the test specimen during testing. Therefore, if the needle-point  
10 significantly adversely affects the test specimen (for example, punctures an inflatable structure), then the needle-point should not be used. The bottom of the plunger should be set well above the top of the orifice plate. From this position, the downward stroke of the ball nose is to be the exact bottom of the plate orifice.

15 A force-measurement gauge and more specifically an Instron inverted compression load cell. The load cell has a load range of from about 0.0 to about 2000.0 grams.

An actuator, and more specifically the Instron Model No. 1122 having an inverted compression load cell. The Instron 1122 is made by the Instron Engineering Corporation, Canton, Mass.

#### Number and Preparation of Specimens

20 In order to perform the procedure for this test, as explained below, five representative absorbent articles are necessary. From one of the five articles (having, of course, any panty adhesive release paper removed and any adhesive blocked) to be tested, some number "Y" of 37.5 X 37.5 millimeter test specimens are cut. If the size of the acquisition zone to be tested is smaller than the size of 37.5 X 37.5 millimeter, then the  
25 acquisition zone with a portion of the periphery zone may be cut out such that the size of a sample becomes 37.5 X 37.5 millimeter. In this case, the center of the acquisition zone is adjusted to align with the center of the sample of 37.5 X 37.5 millimeter. Specimens having portions in which a topsheet is joined directly to a barrier sheet or which are a laminate of a topsheet, two or less tissue sheets and a barrier sheet, should not be tested.  
30 The reason that these specimens are not tested is due to the realization that prior art absorbent articles exist in which a topsheet is joined to a barrier sheet beyond the edges of an absorbent component in the periphery of the napkin, such portions of which are highly

flexible. However, the present invention is more concerned with the overall flexibility of the absorbent article and not merely the peripheral portions thereof and, therefore, the flexibility of the present invention is more concerned with the flexibility of the significant absorbent portions of the absorbent article. If any of these significant absorbent portions of the absorbent article meet the parameters of this test, then the absorbent article satisfies the test. Therefore, a number of different specimens should be tested from each absorbent article. Certainly, the structurally most flexible portion of the absorbent article should be tested, excluding those portions excluded above. The test specimens should not be folded or bent by the test person, and the handling of specimens must be kept to a minimum and to the edges to avoid affecting flexural-resistance properties. From the four remaining absorbent articles, an equal number "Y" of 37.5 X 37.5 millimeter specimens, identical to the specimens cut from the first absorbent article, are cut. Thus, the test person should have "Y" number of sets of five identical specimens.

The procedure for the Circular Bend Procedure is as follows. The specimens are conditioned by leaving them in a room which is  $21 \pm 1^\circ\text{C}$  and  $50 \pm 2\%$  relative humidity for a period of two hours. The tests described herein are conducted under similar conditions. The test plate is leveled. The plunger speed is set at 50.0 centimeters per minute per full stroke length. A specimen is centered on the orifice below the plunger such that the body surface of the specimen is facing the plunger and the garment surface of the specimen is facing the platform. Of course, any panty adhesive release paper (if present) is removed, to simulate in-use conditions. Any panty adhesive (if present) should be blocked, using means well known to those skilled in the art, such as glycerin and/or powder, to prevent the specimen from adhering to the platform and an artificially high peak bending stiffness being obtained. If desired, the specimen may be centered over the orifice with the body surface facing the platform and the garment surface facing the plunger to obviate the need for blocking any adhesive which may be present. The indicator zero is checked and adjusted, if necessary. The plunger is actuated. Touching the specimen during the testing should be avoided. The maximum force reading to the nearest gram is recorded. The above steps are repeated until all five of the identical specimens have been tested.

### Calculations

The peak bending stiffness for each specimen is the maximum force reading for that specimen. Each set of five identical specimens is tested and the five values received for that set are averaged. Thus, the test person now has an average value for each of the "Y" sets tested. The flexure-resistance for an absorbent article is the greatest flexibility of these average peak bending stiffnesses.

#### B. Capacity

The total capacity of an absorbent article is determined as follows. Any panty adhesive release paper is removed from the article to be tested. The article is weighed to the nearest 0.1 gram. The article is then submerged in a beaker of sterile saline (obtainable from the Baxter Travenol Company of Deerfield, Illinois), such that the article is totally submerged and is not bent or otherwise twisted or folded. The article is submerged for 10 minutes. The article is removed from the saline and suspended for two minutes in a vertical position to allow the saline to drain out of the article. The article is then placed body facing surface down onto an absorbent blotter, such as the filter paper #631 available from the Filtration Science Corp., Eaton-Dikeman Division of Mount Holly Springs, PA. A uniform 17.6 grams per square centimeter load is placed over the article to squeeze excess fluid out. The absorbent blotter is replaced every 30 seconds until the amount of fluid transferred to the absorbent blotter is less than 0.5 grams in a 30 second period. Next, the article is weighed to the nearest 0.1 gram and the dry weight of the article is subtracted. The difference in grams is the total capacity of the article. This concludes the test.

The disclosures of all patents, patent applications (and any patents which issue thereon, as well as any corresponding published foreign patent applications), and publications mentioned throughout this patent application are hereby incorporated by reference herein. It is expressly not admitted, however, that any of the documents incorporated by reference herein teach or disclose the present invention. It is also expressly not admitted that any of the commercially available materials or products described herein teach or disclose the present invention.

It should also be understood that all of the limits and ranges specified herein include all narrower ranges, limits, and amounts that are within the specified limits and

ranges and that such narrower ranges and limits may be claimed even though those limits and ranges are not separately listed.

5 While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An absorbent article for wearing in a supporting garment, the absorbent article having a body facing side and a garment facing side, the absorbent article comprising a topsheet disposed at the body facing side, a backsheet disposed at the garment facing side; and an absorbent component, wherein  
5 the absorbent article has an acquisition zone and a periphery zone,  
the topsheet has a topsheet opening at the acquisition zone, and the topsheet extends at the periphery zone,  
the absorbent component at the acquisition zone is exposed through the topsheet opening,  
10 the acquisition zone is capable of substantially maintaining sustained contact with and covering at least a portion of the surface of the wearer's labia minora when the absorbent article is applied on the wearer's body, and  
the periphery zone covers at least a portion of the surface of the wearer's labia majora when the absorbent article is applied on the wearer's body.
2. The absorbent article of Claim 1 wherein the acquisition zone has a flexure resistance of less than or equal to 100 grams to substantially maintain sustained contact with at least a portion of the surface of the wearer's labia minora.
3. The absorbent article of Claim 2 wherein the acquisition zone covers a portion of the interior surface of the wearer's labia minora.
4. The absorbent article of Claim 3 wherein the acquisition zone covers a portion of the exterior surface of the wearer's labia minora.
5. The absorbent article of Claim 4 wherein the acquisition zone covers a portion of the surface of the wearer's labia majora.
6. The absorbent article of Claim 5 wherein the periphery zone covers a portion of the surface of the wearer's body outside the wearer's labia majora.

7. The absorbent article of Claim 1 wherein the acquisition zone has a lateral width of between 10 mm and 60 mm.
8. The absorbent article of Claim 7 wherein the acquisition zone has a longitudinal length of between 30 mm and 120 mm.
9. The absorbent article of any of Claim 1 through 7 wherein the absorbent component includes a storage layer and a distribution layer, wherein the distribution layer is exposed at least at the acquisition zone.
- 5 10. An absorbent article for wearing in a supporting garment, the absorbent article having a body facing side and a garment facing side, the absorbent article comprising a topsheet disposed at the body facing side, a backsheet disposed at the garment facing side, and an absorbent component, wherein  
the absorbent article has an acquisition zone and a periphery zone,  
the topsheet has a topsheet opening at the acquisition zone, and the topsheet extends  
10 at the periphery zone,  
the absorbent component includes a storage layer and a distribution layer,  
the storage layer is disposed adjacent the body facing side and has an acquisition opening at the acquisition zone, and the storage layer extends at the periphery zone,  
the distribution layer is disposed adjacent the garment facing side, and the  
15 distribution layer extends underneath the acquisition opening and the storage layer,  
the distribution layer is exposed through the topsheet opening and the acquisition opening,  
the acquisition zone is capable of substantially maintaining sustained contact with  
and covering at least a portion of the surface of the wearer's labia minora when the  
20 absorbent article is applied on the wearer's body, and  
the periphery zone covers at least a portion of the surface of the wearer's labia majora when the absorbent article is applied on the wearer's body.

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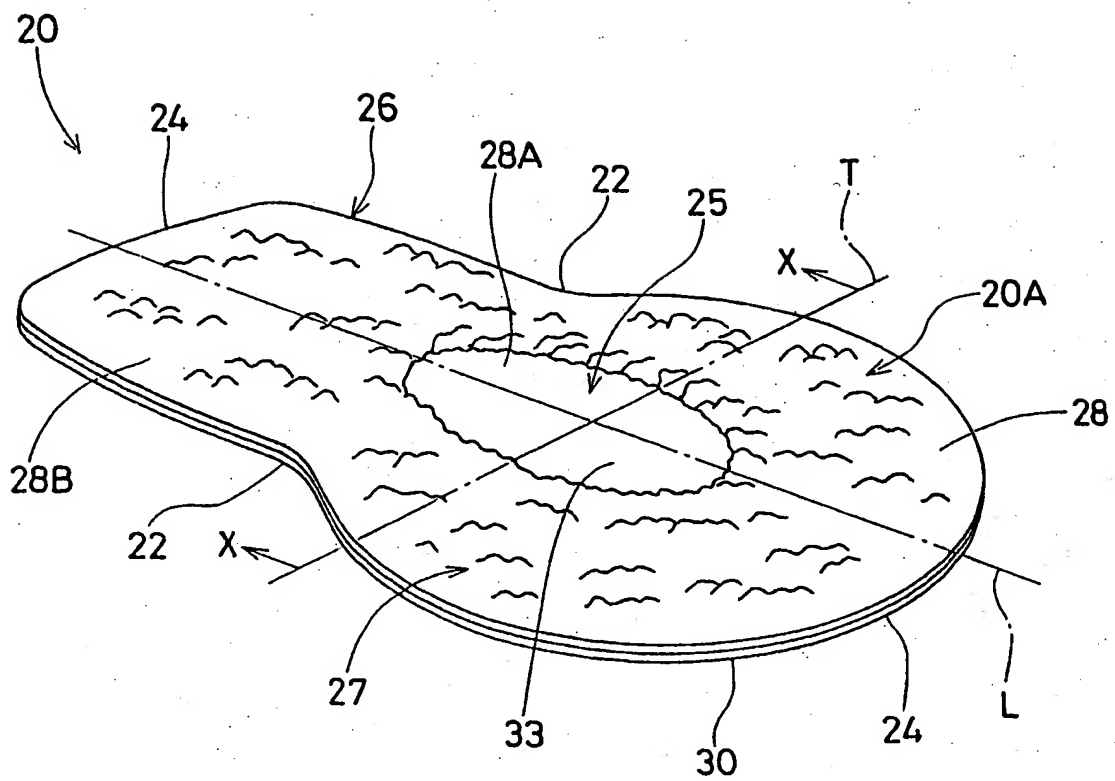


FIG. 1



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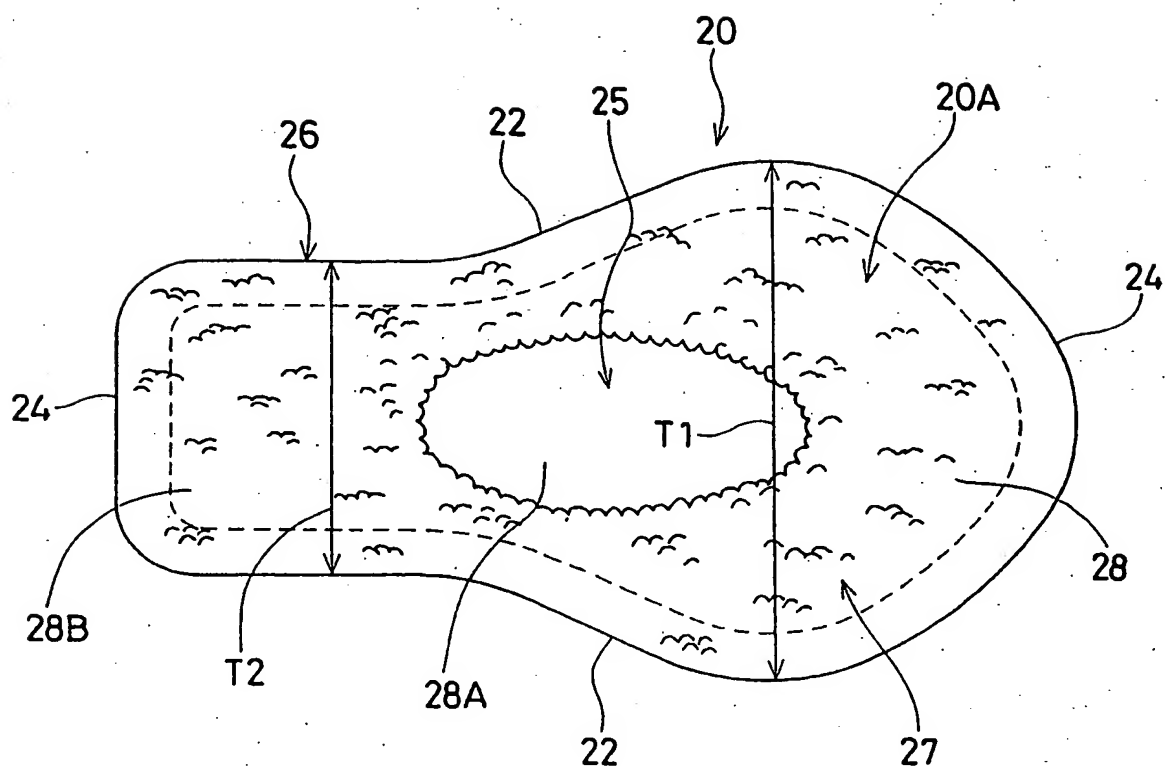


FIG. 2

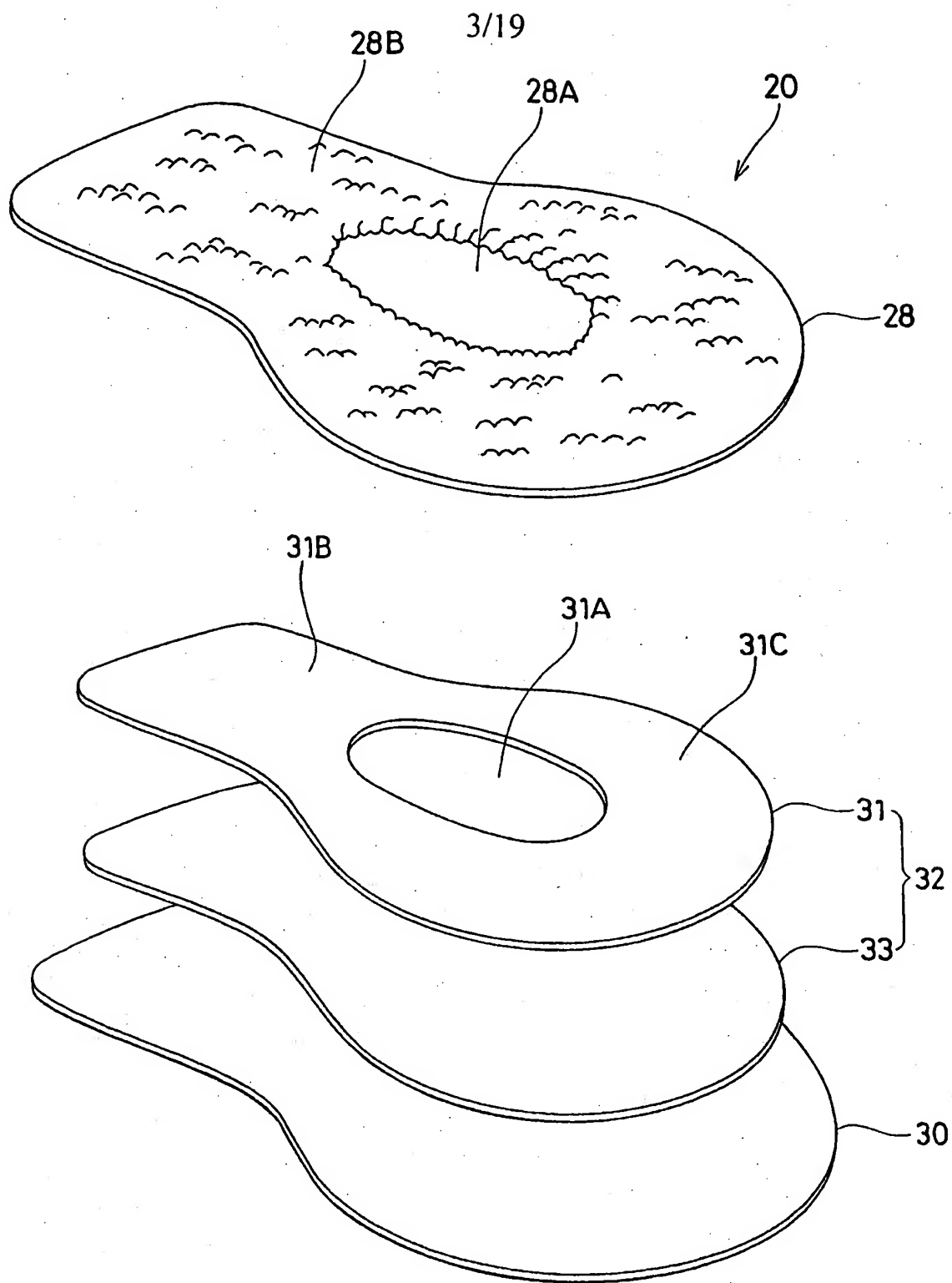


FIG. 3

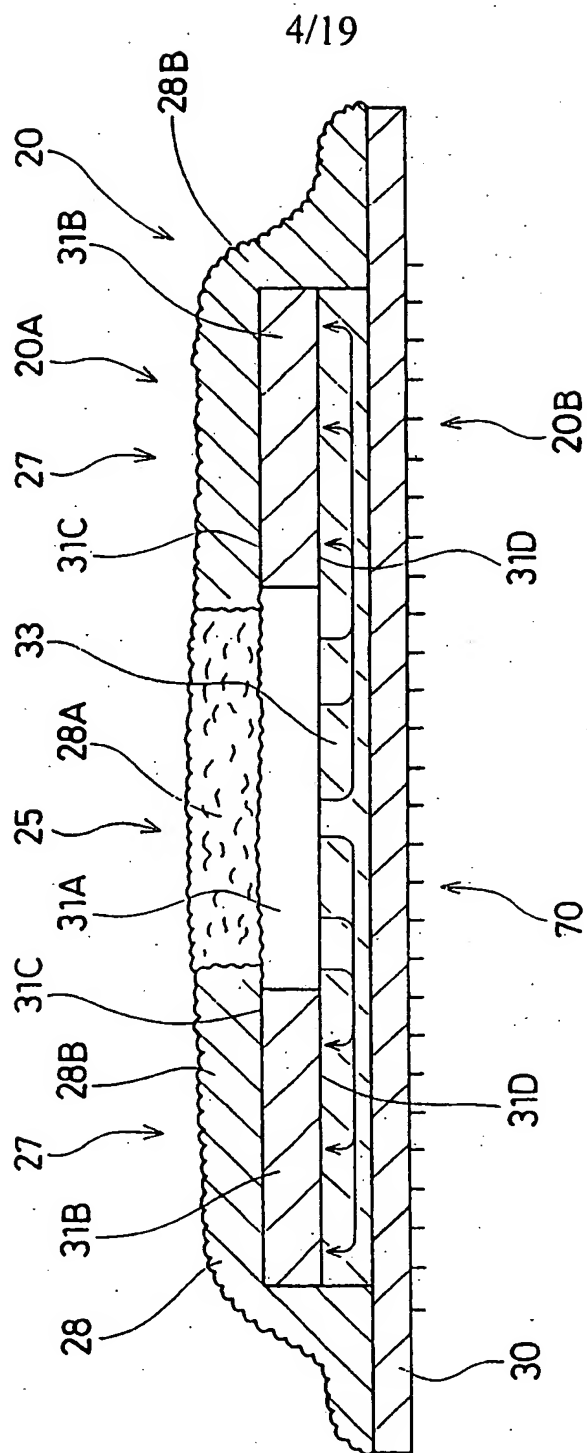


FIG. 4

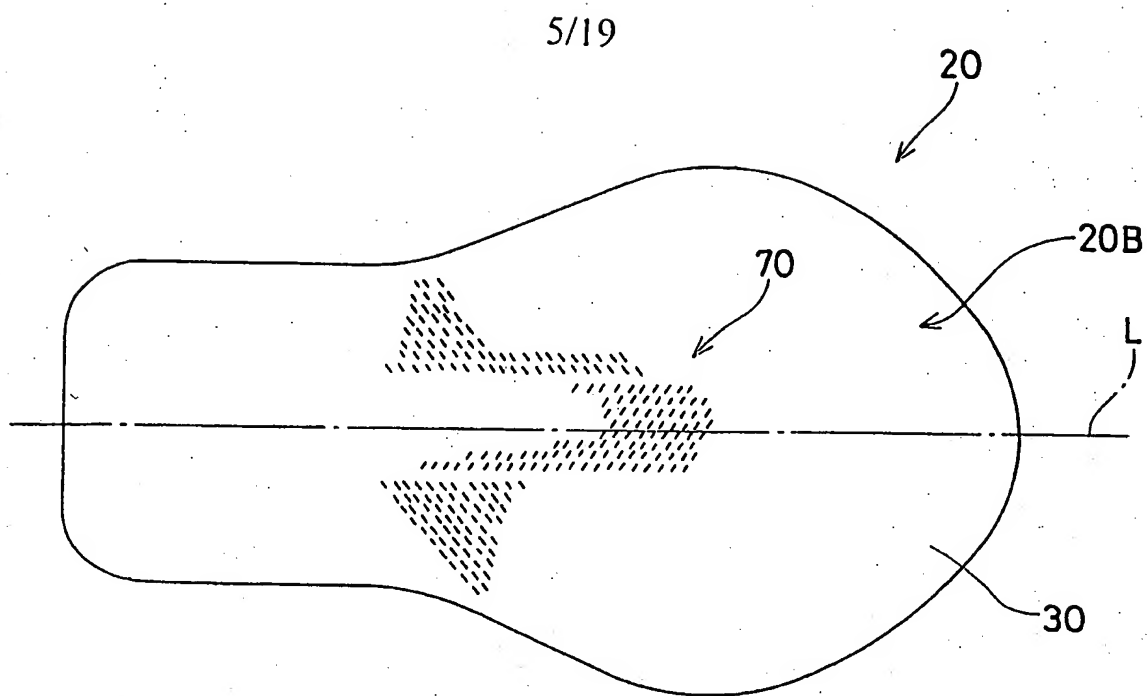


FIG. 5

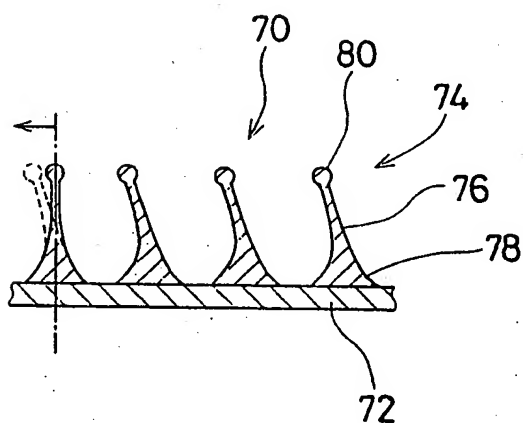


FIG. 6

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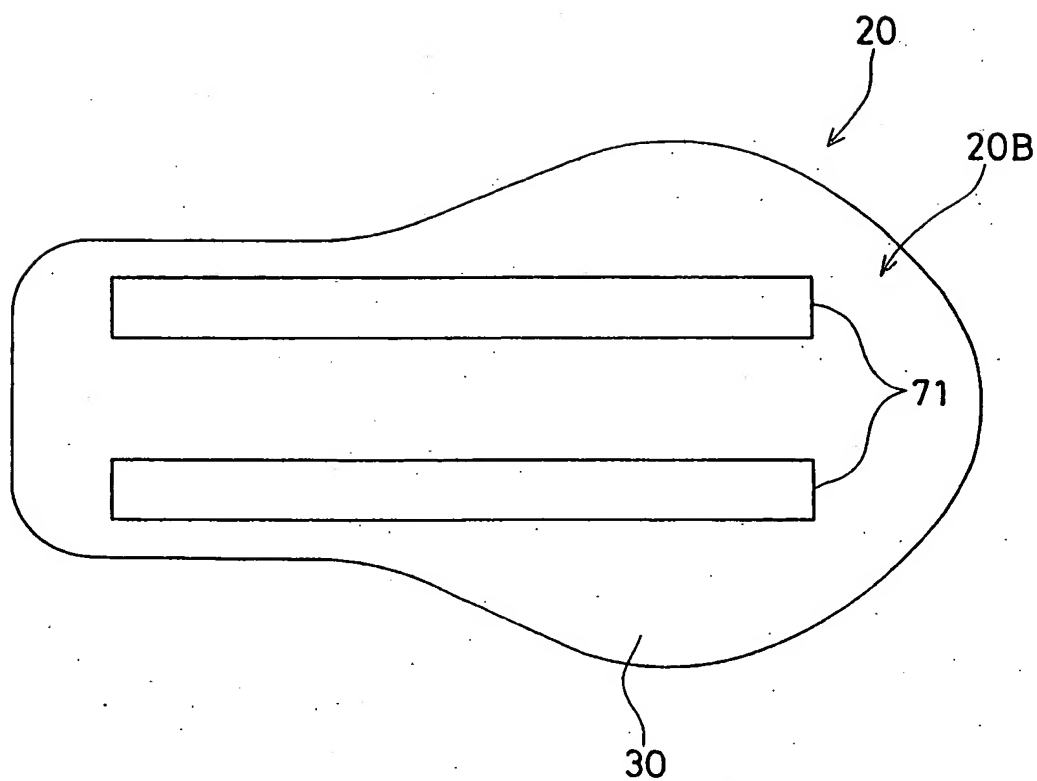


FIG. 7

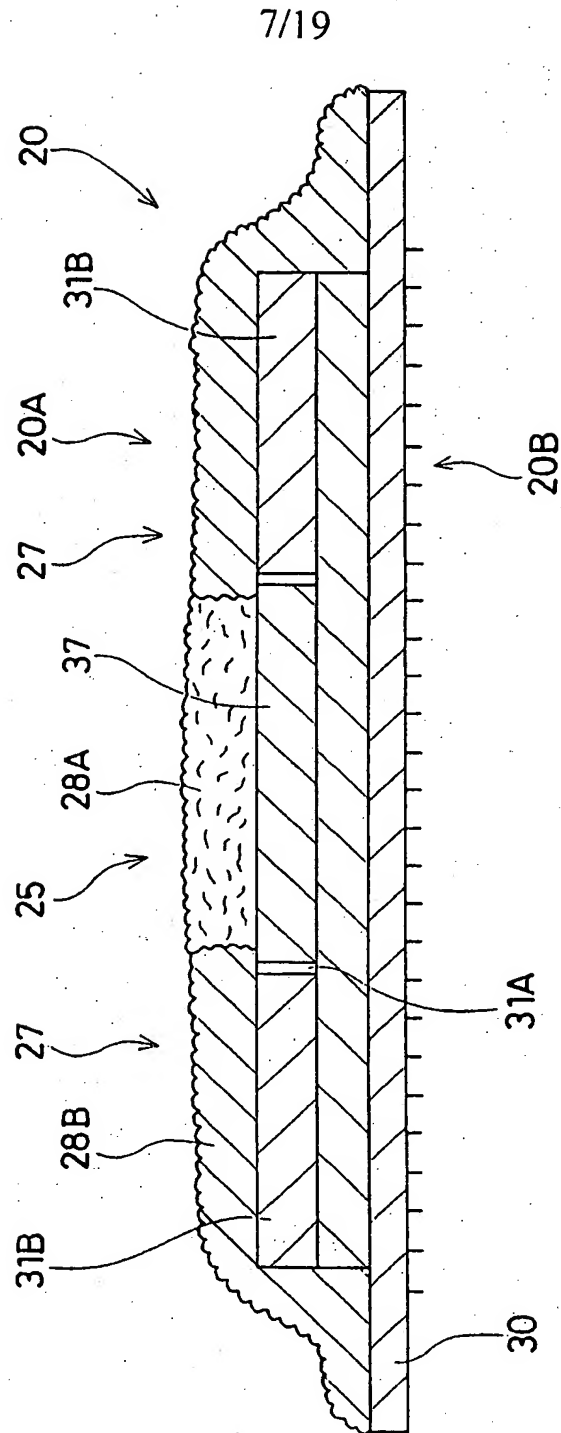


FIG. 8

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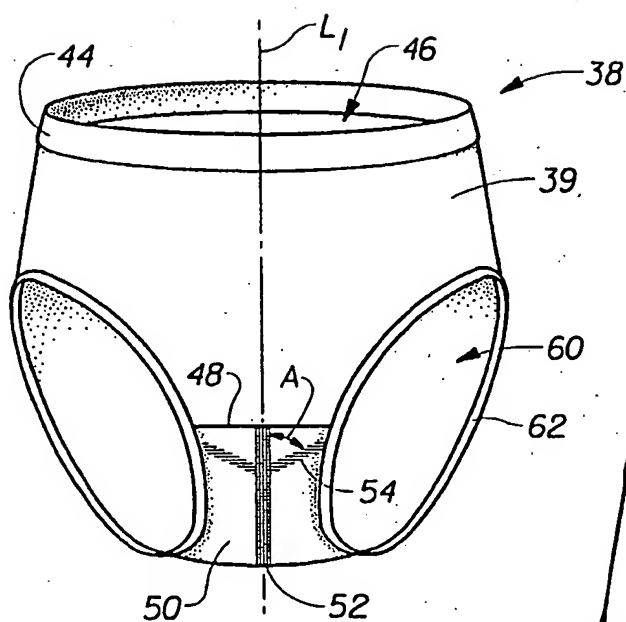


Fig 9

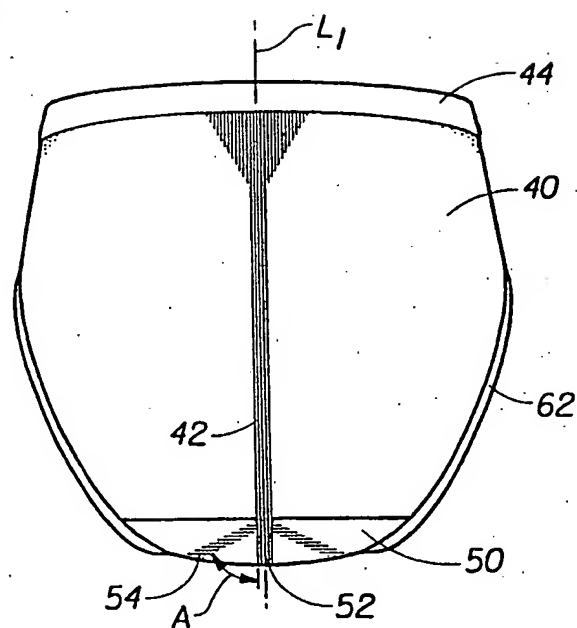
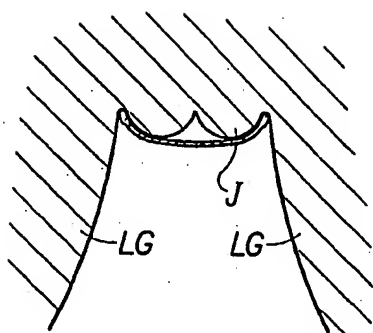
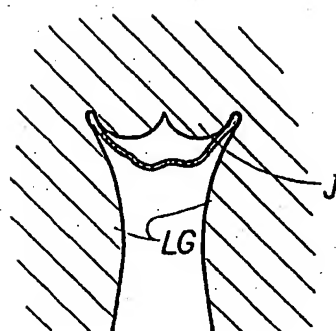


Fig 10

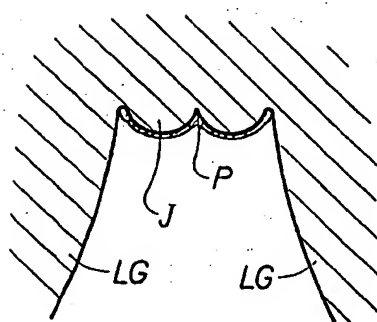
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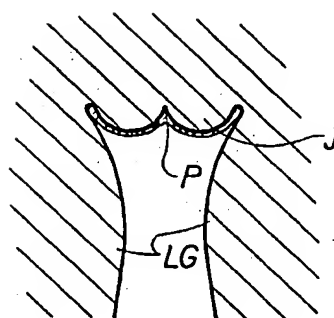
**Fig 11**  
Prior Art



**Fig 12**  
Prior Art



**Fig 17**



**Fig 18**



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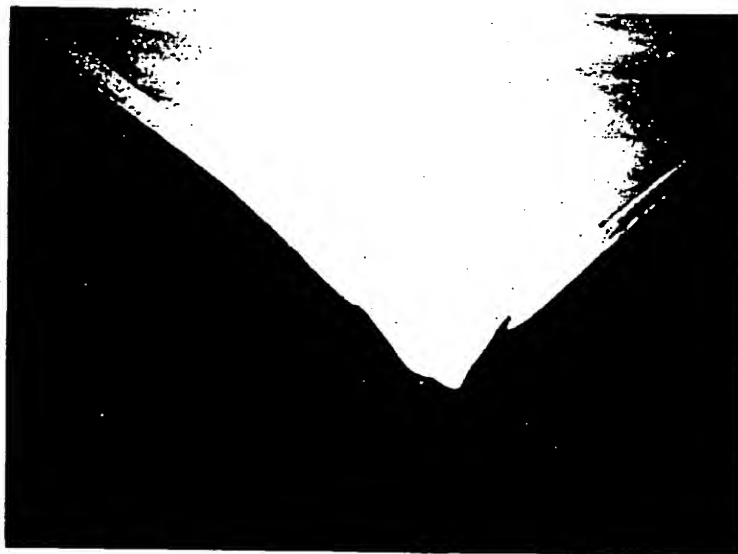


FIG. 14  
Prior Art

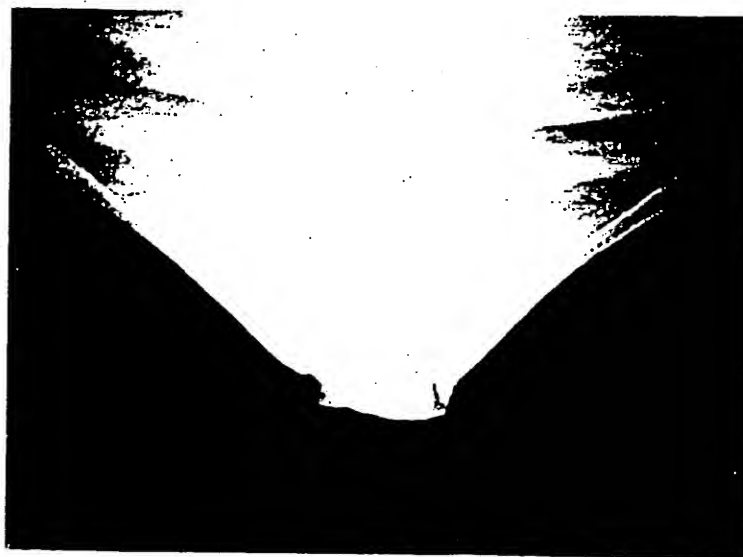


FIG. 13  
Prior Art

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FIG. 16

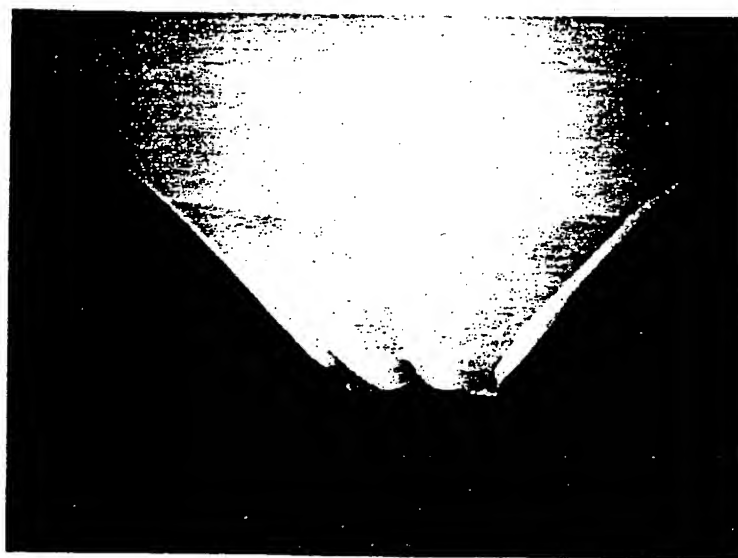


FIG. 15

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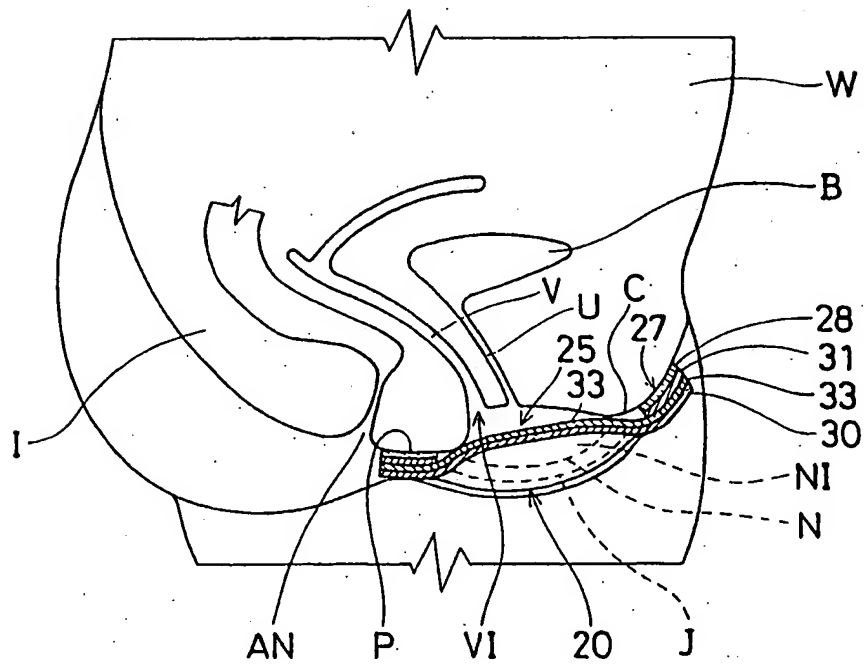


FIG. 19

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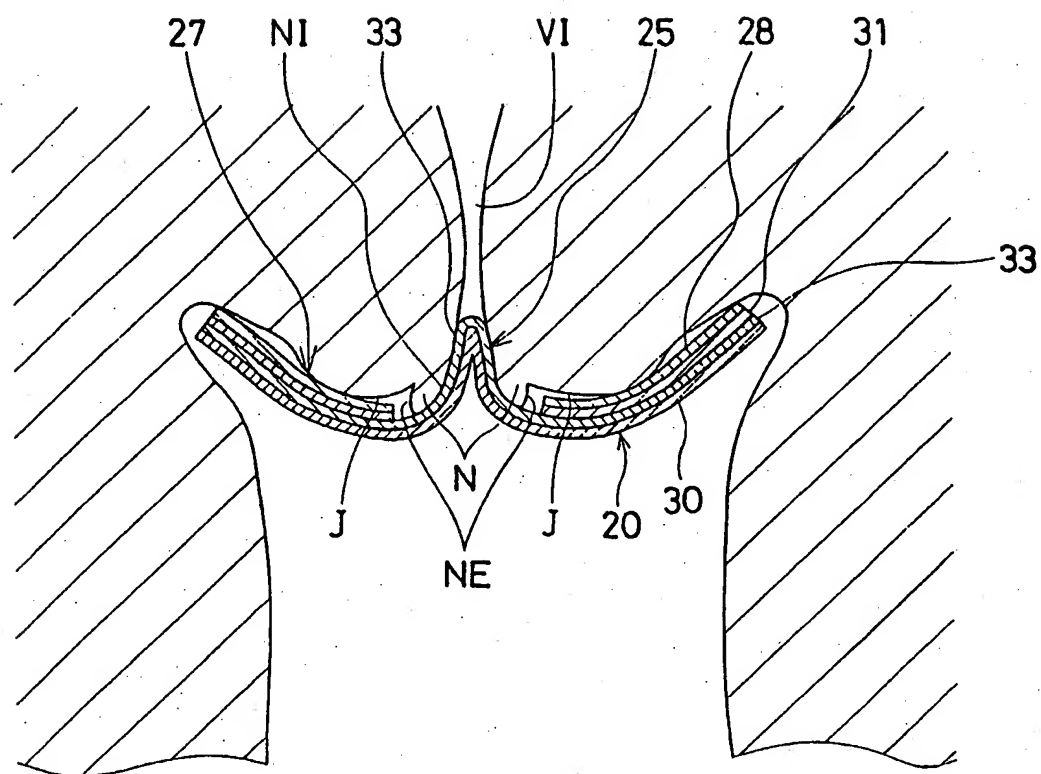


FIG. 20

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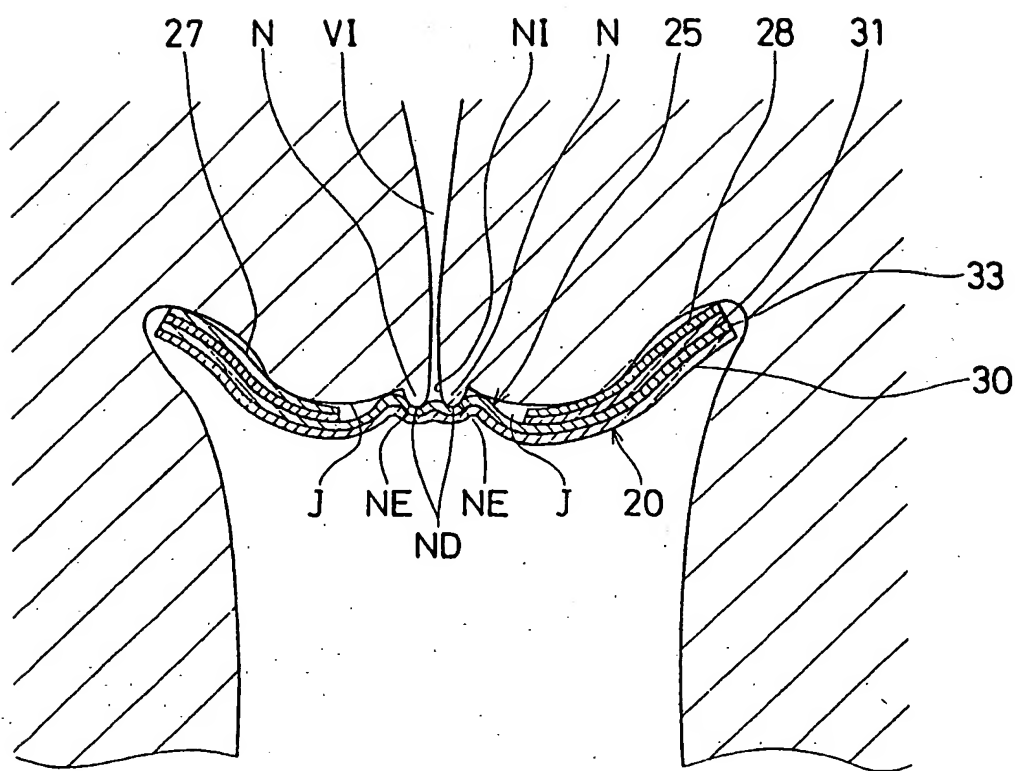


FIG. 21

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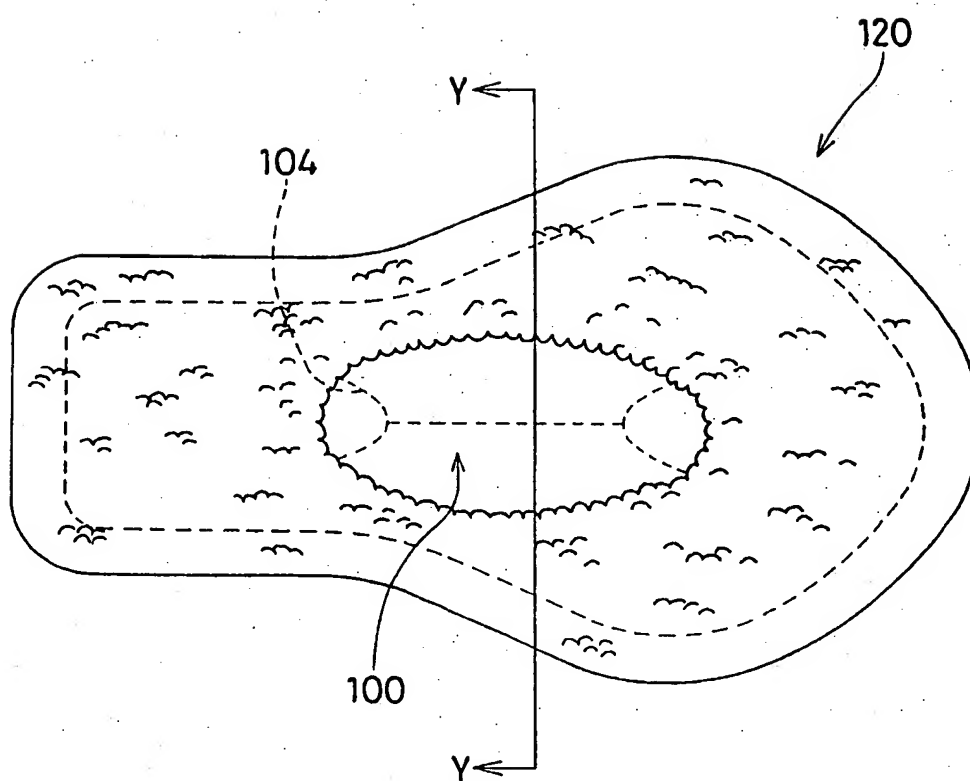


FIG. 22

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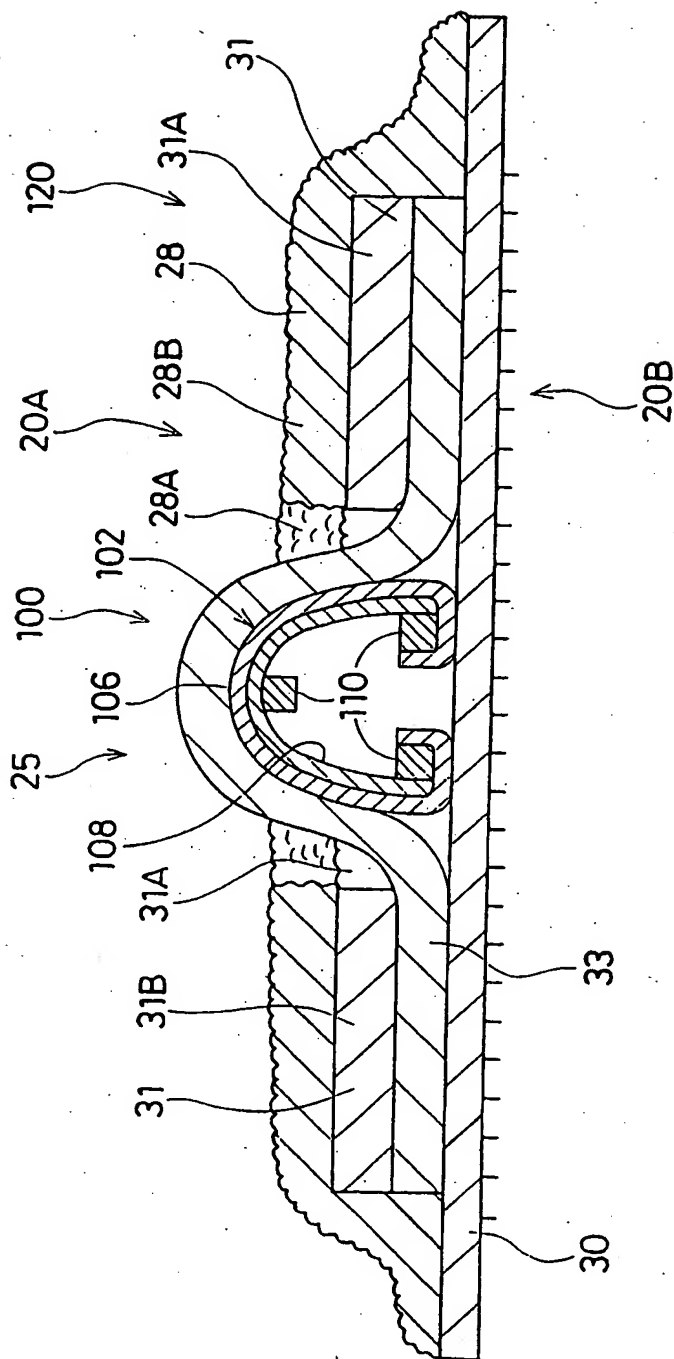


FIG. 23

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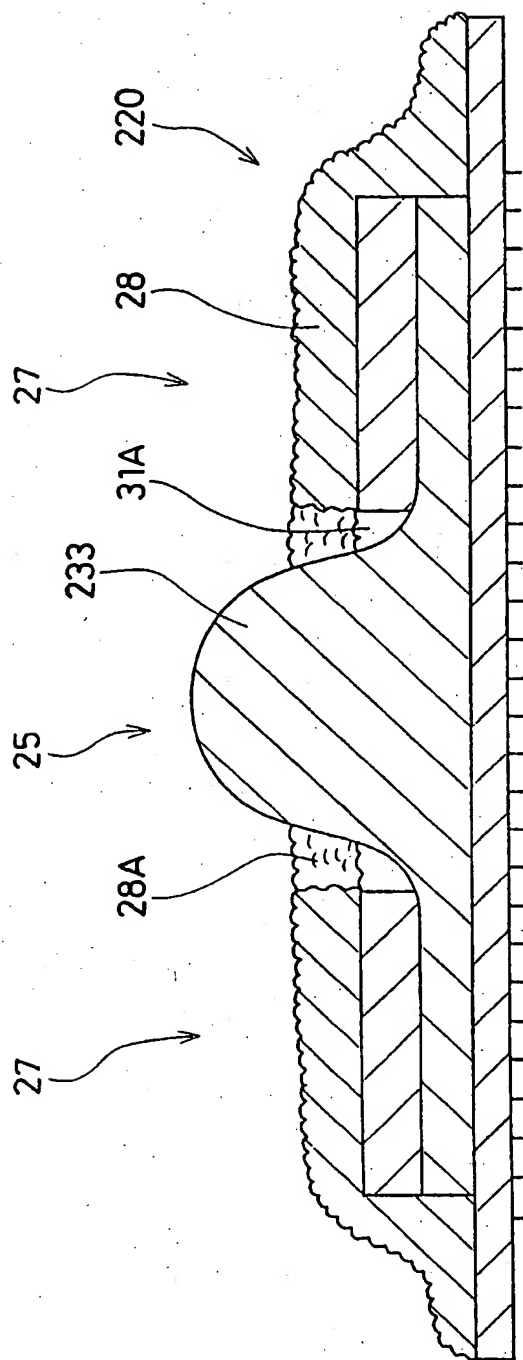


FIG. 24



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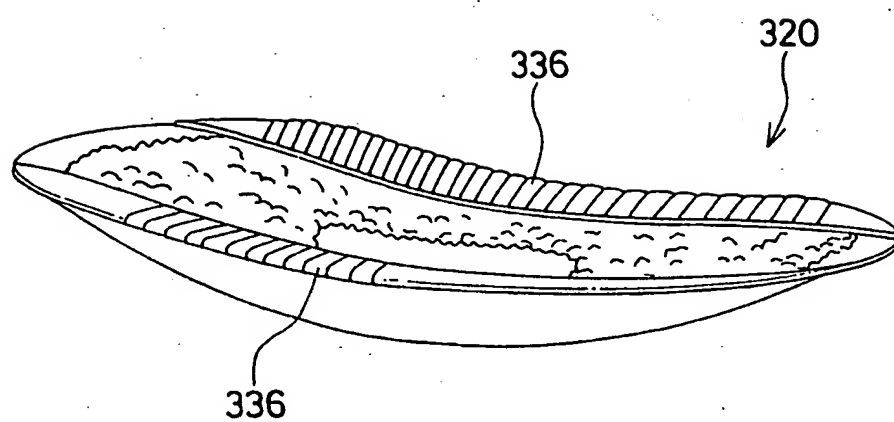


FIG. 25

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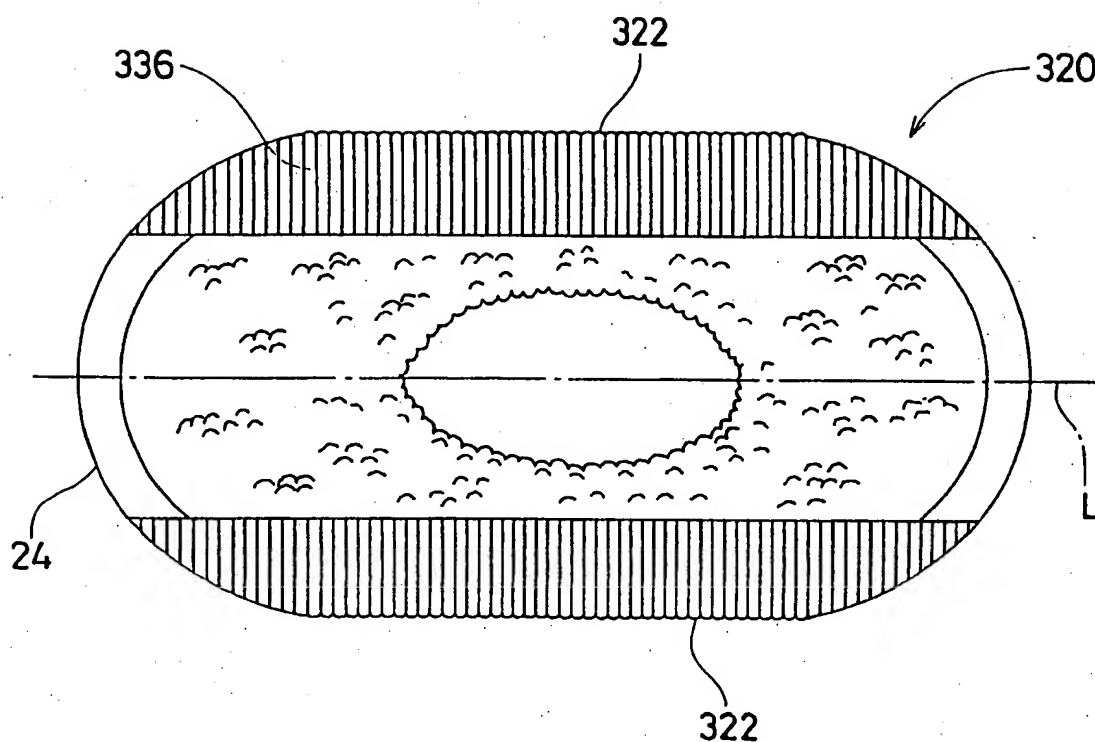


FIG. 26

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/27273

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 319 186 A (MOELNLYCKE AB) 20 May 1998 (1998-05-20) page 8, line 14 - line 24 page 9, line 12 - line 15 page 10, line 12 - line 15 page 11, line 27 - line 34; figure 1	1,3-6,9, 10
A	US 4 673 403 A (NICHOLS ANN M ET AL) 16 June 1987 (1987-06-16) column 10, line 34 - line 39 column 14, line 59 - line 62; claim 1; figures 2,13A	1,3-6,9, 10
A	US 5 647 863 A (HAMMONS JOHN L ET AL) 15 July 1997 (1997-07-15) abstract; figure 1	1,10

☐ Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

14 September 1999

Date of mailing of the international search report

23/09/1999

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Westermayer, W

# INTERNATIONAL SEARCH REPORT

Information on patent family members.

International Application No

PCT/US 98/27273

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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